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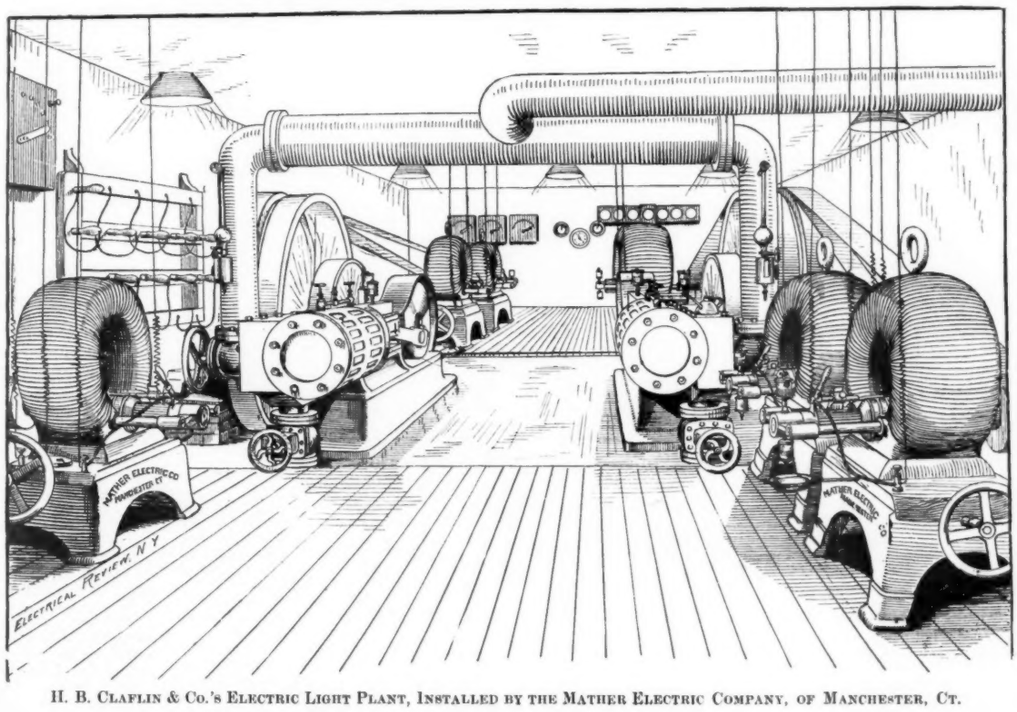
A Notable Mather Plant in New York.

The accompanying illustration gives a very good idea of an important plant now in successful operation in this city. The firm of H. B. Claflin & Company, the largest wholesale dry goods and importing firm in the world, are the owners of the plant which is installed in their building on Church and Worth streets, and West Broadway. Power is furnished by two automatic cut-off Buckeye engines, each running at a speed of 245 revolutions per minute, with a 13-inch stroke. These drive five arc dynamos of 25 lights capacity each, and one large incandescent dynamo furnishing current for 580 16 c. p. lamps. All of these are of the latest Mather type. Each engine drives three dynamos, the right hand engine shown in the illustration driving the incandescent dynamo in front and two arc dynamos tandem, behind, while the three remaining arc dynamos are driven by the engine on the left, two in fron tandem and one be hind. The dynamos are all set in iron bases and provided with improved ap pliances for catching waste oil. The arc light service is divided into five circuits of 25 lamps each, with ammeters, suitable switchboards, etc., in the dynamo room, so that any one of the dynamos can be used on any circuit, supplying any number of lamps up to capacity. The arc lights are used on the main floors of the building, and several are placed over the sidewalk.

The current from the incandescent dynamo is carried by main safety distributors to switches which control eight branch circuits, also arranged with safety distributors and safety cut-outs for all the lamps. The incandescent plant is all supplied with necessary volt and ammeters. The office, cellar and basement are lighted with the incandescent lamps.

The entire plant works to the satisfaction of those benefited by the light and of the superintending electrician, Mr. F. G. Gibson, alike.



H. B. CLAFLIN & CO.'S ELECTRIC LIGHT PLANT, INSTALLED BY THE MATHER ELECTRIC COMPANY, OF MANCHESTER, CT.

Helping in Newspaper Work.

The Detroit *Free Press* is using the phonograph in its office as an adjunct to the local staff. Just what the new reporter is expected to do is thus described:

Its use in the city department it is believed will be accompanied by beneficial results. Much time is lost by reporters in transcribing their notes. This time is not so much lost as consumed. In cases of emergency, where there is a rush of news, time is of the greatest value to the newspaper. By the introduction of the phonograph into the local department this time will be economized. For instance, a reporter will come in with some matter of not paramount importance, while a piece of news of very much greater importance, and which perhaps requires the services of two or three men, is awaiting the attention of the local staff. The reporter who has covered the piece of minor news can leave his notes with the city editor, who will have the story in complete form talked into the phonograph and the typewriter will transcribe the matter. Meanwhile this reporter's services can be used to better advantage to the paper and for the public in covering the more important occurrence. Again should he have an important piece of news he can tell his story to the phonograph and the typewriter and save his time for the paper. Which ever way it may be viewed it will be found advantageous.

A New Arc Lamp.

The "New" Electric Light Company, of Broadway, New York, are putting on the market their new form of arc lamp, in which the feed is governed entirely by a solenoid core. The carbon is attached directly to the solenoid core, and the apparatus is entirely free from catches, springs or mechanism of any kind, and is entirely automatic in its operation. The lamps are made for the 110 volt incandescent circuit, and are also adapted by shunt arrangements, to the arc or alternating currents. The company claim for their lamp simplicity and economy, together with a soft white light, free from hissing, and burning steadily. Several lamps on exhibition at the company's offie, bear out the latter's claims, and a 2,000 candle power lamp, requiring from ½ to ⅝ of a horse power, 450 to 460 watts, are the figures claimed on the score of economy.

Locating Sea Signals.

A party of Boston gentlemen, including Frederick Warren of the Warren line of steamers, Hugh Allan of the Allan line, Henry Hovey, the owner of the yacht "Fortune," Joseph Stillman, W. B. Thomas, W. S. Graff Baker, William De Ford and others, went down the harbor Thursday afternoon to witness the first Boston exhibition of the eophone, an instrument for determining the location of the source of sounds, for the benefit of navigators. Its merits were amply demonstrated to the persons who were present at the exhibition.

The instrument was temporarily constructed in the pilot house of the tugboat "W. S. Sprague," and the exact location of the sources of all the sounds, not only from the tugboat that led the "Sprague," but from the "Echo" signals and the bell buoy were precisely determined upon by all the members of the party.

The inventors of this apparatus are Messrs. Baker and Della Torre, of Baltimore.

First Report of Cincinnati's Electrician.

Prof. French, the recently appointed consulting electrician, of Cincinnati, has sent the following to the Board of Public Affairs:

"CINCINNATI, May 29, 1889.

"Gentlemen—Acknowledging the receipt of your official communication advising me of my appointment as consulting electrician, I have the honor, in pursuance of the duty assigned me, to report that my examination of electrical constructions in the city has advanced far enough to lead me to make at this time the following preliminary recommendations:

"First—That the further stringing of so-called underwriters' wire for any purposes of electric light and power be prohibited.

"Second—That all authorized companies submit for examination and approval samples of the wires which they may desire to string, and that permits to string said wires be issued only after your approval of the same.

"Third—That a set of rules and regulations, covering all essential points of electrical construction, be framed and passed at the earliest practicable day, and that all electrical companies be required to conform to the same.

"Fourth—Relative to the communication from the Brush Electric Light Company, requesting permission to string wires to and from poles erected by them from time to time, I respectfully recommend that action be taken in conformity with the second of the above recommendations.

"Respectfully submitted,

"THOS. FRENCH, JR."

A New Electric Train Signal.

Three Bloomington, Ills., railroad men have just perfected an ingenious electric train signal that is a great improvement on the old bell and cord. The device was put in operation for the first time on the Chicago and Alton. Each car is fitted up with a small magneto-electric machine operated by a crank, and connections are made directly to the engine by means of a wire that passes along the base of the air-break beneath the cars. A gong is placed in the cab of the engine and is readily sounded by generating a current by turning the magneto crank. The gong is prevented from being sounded by the jar of the locomotive and thus giving false signa by a magnet which holds the clapper until it is set in motion by the more powerful current from one of the mag netos. The return circuit is made along the rails and upon the truck to a wire connected with the magneto.

The inventors are T. M. Bates, superintendent of transportation; H. V. Miller, superintendent of telegraph of the Chicago and Alton, and J. L. Batchelder. They have obtained a patent and hope soon to place their device upon all trains on the Alton. The advantages over the old method are accuracy, rapidity and durability. The old-fashioned bell-cords are continuously breaking, and on long trains are practically useless on account of the slack. The electric train signal can also be applied on freight trains and operated from the caboose.

—The contract for the work on the Electric Light Company's plant at Andover, Mass., has been awarded. It includes putting in the foundation for a brick building 50x72 feet and a chimney 80 feet high. The building is to have a capacity for six dynamos and three boilers. The work is to be done in 50 days.

On Modern Views With Respect to Electric Currents.

BY PROFESSOR H. A. ROWLAND.

Abstract of a lecture given at the College of the City of New York, May 22, 1889, before the American Institute of Electrical Engineers.

Ladies and Gentlemen—Were I to trace the history of the views of physicists with respect to electric currents, it would include the whole history of electricity. The date when the conception of an electric current was possible was that when Stephen Gray, about 170 years ago, first divided bodies into conductors and non-conductors, and showed that the first possessed the property of transmitting electric attractions to a distance. But it was only when the Leyden jar was discovered that the idea of a current became very definite. The notion that electricity was a subtle fluid which could flow along metal wires as water flows along a tube was then prevalent, and, indeed, remains in force to-day among all except the leaders in scientific thought. It is not my intention to depreciate this notion, which has served and still serves a very important purpose in science. But, for many years, it has been recognized that it includes only a very small portion of the truth, and that the mechanism by which energy is transmitted from one point of space to another by means of an electric current is a very complicated one.

Here; for instance, I have two wires, alike in all respects, except that one has a current of electricity flowing in it and the other has not. But in this case I have only to bring a magnetic needle near the two, to find out in which one the current is flowing. On our ordinary senses the passage of the current has little effect ; the air around it does not turn green or the wire change in appearance. But we have only to change our medium from air to one containing magnetic particles to perceive the commotion which the presence of a current may cause. Thus this other wire passes through the air near a large number of small suspended magnets, and, as I pass the current through it, every magnet is affected and tends to turn at right angles to the wire and even to move toward it and wrap itself around it. If we suppose the number of these magnets to become very great and their size small, or, if we imagine a medium, every atom of which is a magnet, we see that no wire carrying a current of electricity can pass through it without creating the greatest commotion. Possibly this is a feeble picture of what takes place in a mass of iron near an electric current.

Again, coil the wire around a piece of glass, or, indeed, almost any transparent substance, and pass a strong current through the wire. With our naked eye alone we see no effect whatever, as the glass is apparently unaltered by the presence of the current, but, examined in the proper way by means of polarized light, we see that the structure of the glass has been altered throughout in a manner which can only be explained by the rotation of something within the glass many millions of times every second

Once more, bring a wire in which no current exists nearer and nearer to the one carrying the current and we shall find that its motion in such a neighborhood causes or tends to cause an electric current in it. Or, if we move a large solid mass of metal in the neighborhood of such a current we find a peculiar resistance unfelt before, and if we force it into motion we shall perceive that it becomes warmer and warmer as if there was great friction in moving the metal through space.

Thus, by these tests, we find that the region around an electric current has very peculiar properties which it did not have before, and which, although stronger in the neighborhood of the current, still extend to indefinite distances in all directions, becoming weaker as the distances increase.

How great then the difference between a current of water flowing in a tube and a current of electricity. The action of the former is confined to the interior of the tube, while that of the latter extends to great distances on all sides, the whole of space being agitated by the formation of an electric current in any part. To show this agitation, I have here two large frames with coils of wire around them. They hang face to face about six feet apart. Through one I discharge this Leyden jar, and immediately you see a spark at a break in the wire of the other coil, and yet there is no apparent connection between the two. I can carry the coils 50 feet or more apart, and yet, by suitable means, I can observe the disturbances due to the current in the first coil.

The question is forced upon us as to how this action takes place. How is it possible to transmit so much power to such a distance across apparently unoccupied space? According to our modern theories of physics there must be some medium engaged in this transmission. We know that it is not the air, because the same effects take place in a vacuum, and, therefore, we must fall back on that medium which transmits light and which we have named the ether. That medium which is supposed to extend unaltered throughout the whole of space, whose existence is very certain, but whose properties we have yet but vaguely conceived.

I cannot, in the course of one short hour, give even an idea of the process by which the minds of physicists have been led to this conclusion, or the means by which we have finally completely identified the other which transmits light with the medium which transmits electrical and magnetic disturbances. The great genius who first identified the two is Maxwell, whose electromagnetic theory of light is the center around which much scientific thought is to-day revolving, and which we regard as one of the greatest steps by which we advance nearer to the understanding of matter and its laws. It is this great discovery of Maxwell which allows me, at the present time, to attempt to explain to you the wonderful events which

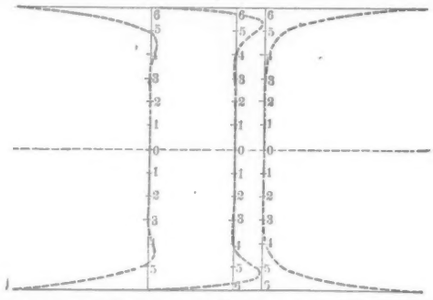


FIG. 1.—PENETRATION OF ALTERNATING CURRENT IN A ROUND SOLID CONDUCTOR.

happen everywhere in space when one establishes an electric current in any other portion.

In the first place, we discover that the disturbance does not take place in all portions of space at once, but proceeds outwards from the center of the disturbance with a velocity exactly equal to the velocity of light. So that, when I touch these wires together so as to complete the circuit of yonder battery, I start a wave of ethereal disturbance which passes outward with a velocity of 185,000 miles per second, thus reaching the sun in about eight minutes, and continuing to pass outwards forever or until it reaches the bounds of the universe. And, yet, none of our senses inform us of what has taken place unless we sharpen them by the use of suitable instruments. Thus, in the case of these two coils of wire, suspended near each other, which we have already used, when the wave from the primary disturbance reaches the second coil, we perceive the disturbance by means of the spark formed at the break in the coil. Should I move the coils further apart, the spark in the second coil would be somewhat delayed, but the distance of 185,000 miles would be necessary before this delay could amount to as much as one second. Hence the effects we observe on the earth take place so nearly instantaneously that the interval of time is very difficult to measure, amounting, in the present case, to only $\frac{1}{1500000}$th of a second.

It is impossible for me to prove the existence of this interval, but I can at least show you that waves have something to do with the action here observed. For instance, I have here two tuning forks mounted on sounding boxes and tuned to exact unison. I sound one and then stop its vibrations with my hand ; instantly you hear that the other is in vibration, caused by the waves of sound in the air between the two. When, however, I destroy the unison by fixing this piece of wax on one of the forks, the action ceases.

Now, this combination of a coil of wire and a Leyden jar, a vibrating system for electricity and its time of vibration is about 10,000,000 times a second. This second system is the same as the first, and therefore its time of vibration is the same. You see how well the experiment works now because the two are in unison. But let me take away this second Leyden jar, thus destroying the unison, and you see that the sparks instantly cease. Replacing it, the sparks reappear. Adding another on one side and they disappear again, only to reappear when the system is made symmetrical by placing two on each side.

This experiment and that of the tuning forks have an exact analogy to one another. In each we have two vibrating systems connected by a medium capable of transmitting vibrations, and they both come under the head of what we know as sympathetic vibrations. In the one case, we have two mechanical tuning forks connected by the air ; in the other, two pieces of apparatus, which we might call electrical tuning forks, connected by the luminiferous ether. The vibrations in one case can be seen by the eye or heard by the ear, but in the other case they can only be perceived when we destroy them by making them produce a spark. The fact that we are able to increase the effect by proper tuning demonstrates that vibrations are concerned in the phenomenon. This can, however, be separately demonstrated by examinining the spark by means of a revolving mirror, when we find that it is made up of many successive sparks corresponding to the successive backward and forward movements of the current.

The fact of the oscillatory character of the Leyden jar discharge was first demonstrated by our own countryman, Henry, in 1832, but he pursued the subject only a short distance, and it remained for Sir William Thomson to give the mathematical theory and prove the laws according to which the phenomenon takes place.

Thus, in the case of a charged Leyden jar whose inner and outer coatings have been suddenly joined by a wire, the electricity flows back and forth along the wire until all the energy originally stored up in the jar has expended itself in heating the wire or the air where the spark takes place and in generating waves of disturbance in the ether which move outward into space with the velocity of light. These ethereal waves we have demonstrated by letting them fall on this coil of wire and causing the electrical disturbance to manifest itself by electric sparks.

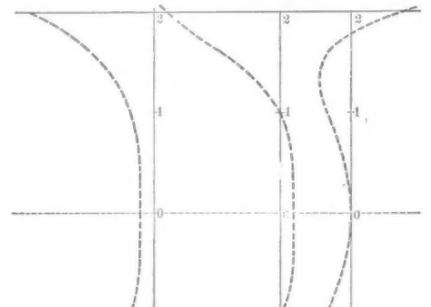


FIG. 2.—PENETRATION OF ALTERNATING CURRENT IN A ROUND SOLID CONDUCTOR.

I have here another more powerful arrangement for producing electro-magnetic waves of very long wave length, each one being about 500 miles long. It consists of a coil within which is a bundle of iron wires. On passing a powerful alternating current through the coil, the iron wires are rapidly magnetized and demagnetized and send forth into space a system of electro-magnetic waves at the rate of 360 in a second.

Here, also, I have another piece of apparatus for sending out the same kind of electro-magnetic waves, and, on applying a match, we start it also into action. But the last apparatus is tuned to so high a pitch that the waves are only $\frac{1}{100000}$ inch long, and 55,000,000,000,000 are given out in one second. These short waves are known by the name of light and radiant heat, though the name radiation is more exact. Placing anybody near the lamp so that the radiation can fall on it, we observe that when the body absorbs the rays it is heated by them ; the well-known property of so-called radiant heat and light. Is it not possible for us to get some substance to absorb the long waves of disturbance and so obtain a heating effect? I have here such a substance in the shape of a sheet of copper, which I fasten on the face of a thermopile, and I hold it where these waves are the strongest. As I have anticipated, great heat is generated by their absorption, and soon the plate of copper becomes very warm, as we see by this thermometer, by feeling of it with the hand or even by the steam from water thrown upon it. In this experiment the copper has not touched the coil or the iron wire core, although if it did they are very much cooler than itself. The heat has been produced by the absorption of the waves in the same way as a blackened body absorbs the rays of shorter wave length from the lamp, and in both cases heat is the result.

But in this experiment, as in the first one, the wave-like nature of the disturbance has not been proved experimentally. We have caused electric sparks, and have heated the copper plate across an interval of space, but have not in either of these cases proved experimentally the progressive nature of the disturbance.

For a ready means of experimenting on the waves, obtaining their wave length and showing their interferences, has hitherto been wanting. This deficiency has been recently overcome by Prof. Hertz, of Carlsruhe, who has made a study of the action of the coil, and has shown us how to use it for experiments on the ethereal waves whose existence had before been made certain by the mathematics of Maxwell.

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Our mathematics has demonstrated, and experiments like those of Professor Hertz have confirmed the demonstration, that the wave disturbance in the ether is an actual fact.

The closing of a battery circuit, then, and the establisment of a current of electricity in a wire is a very different process from the formation of a current of water in a pipe, though after the first shock, the laws of the flow of the two are very much alike. But even then the medium around the current of electricity has very strange properties, showing that it is accompanied by a disturbance throughout space. The wire is but the core of the disturbance, which latter extends indefinitely in all directions.

One of the strangest things about it is that we can calculate with perfect exactness the velocity of the wave propagation and the amount of the disturbance at every point and at any instant of time ; but as yet we cannot conceive of the details of the mechanism which is concerned in the propagation of an electric current. In this respect our subject resembles all other branches of physics in the partial knowledge we have of it.

The electric current is an unsolved mystery, but we have made a very great advance in understanding it when we know that we must look outside of the wire at the disturbance in the medium before we can understand it. A view which Faraday dimly held 50 years ago, which was given in detail in the great work of Maxwell, published 16 years since, and has been the guide to most of the work done in electricity for a very long time. A view which has wrought the greatest changes in the idea which we have conceived with respect to all electrical phenomena.

So far we have considered the case of alternating electric current in a wire connecting the inner and outer coatings of a Leyden jar. The invention of the telephone by which sound is carried from one point to another by means of electrical waves, has forced into prominence the subject of these waves. Furthermore, the use of alternating currents for electric lighting brings into play the same phenomenon. Here, again, the difference between a current of water and a current of electricity is very marked. A sound wave, traversing the water in the tube, produces a to-and-fro current of water at any given point. So, in the electrical vibration along a wire, the electricity moves to and fro along it in a manner somewhat similar to the water but with this difference. The disturbance from the water motion is confined to the tube and the oscillation of the water is greatest in the center of the tube while, in the case of the electric current, the ether around the wire is disturbed and the oscillation of the current is greatest at the surface of the wire and least in its center. The oscillations in the water take place in the tube without reference to the matter outside the tube, whereas the electric oscillations in the wire are entirely depend-

ent on the surrounding space, and the velocity of the propagation is nearly independent of the nature of the wire, provided only that it is a good conductor.

We have them in the case of electrical waves along a wire, a disturbance outside the wire and a current within it, and the equations of Maxwell allow us to calculate these with perfect accuracy and give all the laws with respect to them.

We thus find that the velocity of propagation of the waves along a wire, hung far away from other bodies and made of good conducting material, is that of light, or 185,000 miles per second, but when it is hung near any conducting matter, like the earth, or inclosed in a cable and sunk into the sea, the velocity becomes much less. When hung in space, away from other bodies, it forms, as it were, the core of a system of waves in the ether, the amplitude of the disturbance becoming less and less as we move away from the wire. But the most curious fact is that the electric current penetrates only a short distance into the wire, being mostly confined to the surface, especially where the number of oscillations per second is very great.

The electrical waves at the surface of a conductor are thus, in some respects, very similar to the waves on the surface of water. The greatest motion in the latter case is at the surface while it diminishes as we pass downward and soon becomes inappreciable. Furthermore, the depth to which the disturbance penetrates increases with increase of the length of the wave, being confined to very near the surface for very short waves. So the disturbance in the copper penetrates deeper as the waves and the time of oscillation are longer, and the disturbance is more nearly confined to the surface as the waves become shorter.

I have recently made the complete calculation with respect to these waves, and have drawn some diagrams to illustrate the penetration of the alternating current into metal cylinders. The right-hand curve, Fig. 1, represents the current at different depths in a copper cylinder 45 cm. diameter, or an iron one 14½ cm. diameter, traversed by an alternating current with 200 reversals per second. That and the middle curve show us the current at two different instants of time, and show us how the phase changes as we pass downward into the cylinder. By reference to the middle curve we see that it may be even in the opposite direction in the center of the cylinder from which it is at the surface. The third figure gives us the amplitude of the current oscillations at different depths, irrespective of the phase, and it shows us that the current at the center is only about 10 per cent. of that at the surface in this case. The second diagram, Fig. 2, shows us the distribution in the same cylinders when the number of reversals of the current is increased to 1,800 per second. Here we see that the disturbance is almost entirely confined to the surface, for at a depth of only seven mm., the disturbance almost entirely vanishes.

There are very many practical applications of these theoretical results for electric currents. The most obvious one is to the case of conductors for the alternating currents used in producing the electric light. We find that when these are larger than about half an inch diameter they should be replaced by a number of conductors less than half an inch diameter, or by strips about quarter of an inch thick, and of any convenient width. But this is a matter to be attended to by the electric light companies.

Prof. Oliver J. Lodge has recently, in the B. A., drawn attention to another application of these results, that is, to lightning rods. Almost since the time of Franklin, there are those who advocated the making of lightning rods hollow in order to increase the surface for a given amount of copper. We now know that these persons had no reason for their belief, as they simply drew the inference from the fact that electricity at best is on the surface. Neither were the advocates of the solid rods quite correct, for they reasoned from the fact that electricity in a state of steady flow, occupies the whole area of the conductor equally. The true theory, we now know, indicates that neither party was entirely correct and that the surface is a very important factor in the case of a current of electricity so sudden as that from a lightning discharge. But increase of surface can best be obtained by multiplying the number of conductors, rather than making them flat or hollow, and, at the same time, Maxwell's principle of enclosing the building within a cage can be carried out. Theory indicates that the current penetrates only one-tenth the distance into iron that it does into copper. As the iron has seven times the resistance of copper, we should need 70 times the surface of iron that we should of copper. Hence I prefer copper wire about a quarter of an inch diameter and nailed directly to the house without insulators, and passing down the four corners, around the eaves and over the roof, for giving protection from lightning in all cases where a metal roof and metal down spouts do not accomplish the same purpose.

Whether the discharge of lightning is oscillatory or not does not enter into the question, provided it is only sufficiently sudden. I have recently solved the mathematical problem of the electric oscillations along a perfectly conducting wire joining two infinite and perfectly conducting planes parrallel to each other, and find that there is no definite time of oscillation, but that the system is capable of vibrating in any time in which it is originally started. The case of lightning between a cloud of limited extent and the earth along a path through the air of great resistance is a very different problem. Both the cloud and the path of the electricity are poor conductors, which tends to lengthen the time. If I were called on to estimate as nearly as possible what took place in a flash of lightning, I would say that I did not believe that the discharge was always oscillating, but more often consisted of one or more streams of electricity at intervals of a small fraction of a second, each one continuing for not less than $\frac{1}{1000000}$ second. An oscillating current with 100,000 reversals per second would penetrate about $\frac{1}{60}$ inch into copper and $\frac{1}{300}$ inch into iron. The depth for copper would constitute a considerable proportion of a wire ¼ inch diameter; and, as there are other considerations to be taken into account, I believe it is scarcely worth while making tubes, or flat strips, for such small sizes.

It is almost impossible to draw proper conclusions from experiments on this subject in a laboratory, such as those of Professor Oliver J. Lodge. The time of oscillation of the current in most pieces of laboratory apparatus is so very small, being often the $\frac{1}{100000000}$th of a second, that entirely wrong inferences may be drawn from them. As the size of the apparatus increases, the time of oscillation increases in the same proportion, and changes the whole aspect of the case. I have given $\frac{1}{100000}$th of a second as the shortest time a lightning flash could probably occupy. I strongly suspect it is often much greater, and thus departs even further from the laboratory experiments of Professor Lodge, who has, however, done very much toward drawing attention to this matter and showing the importance of surface in this case. All shapes of the rod with equal surface are not however equally efficient. Thus, the inside surface of a tube does not count at all. Neither do the corrugations on a rod count for the full value of the surface they expose, for the current is not distributed uniformly over the surface; but I have recently proved that rapidly alternating currents are distributed over the surface of very good conductors in the same manner as electricity at rest would be distributed over them, so that the exterior angles and corners possess much more than their share of the current, and corrugations on the wire concentrate the current on the outer angles and diminish it in the hollows. Even a flat strip has more current on the edges than in the center.

For these reasons, shape, as well as extent of surface, must be taken into account, and strips have not always an advantage over wires for quick discharges.

The fact that the lightning rod is not melted on being struck by lightning is not now considered as any proof that it has done its work properly. It must, as it were, seize upon the discharge, and offer it an easier passage to the earth than any other. Such sudden currents of electricity we have seen to obey very different laws from continuous ones, and their tendency to stick to a conductor and not fly off to other objects depends not only on having them of small resistance, but also on having what we call the self-induction as small as possible. This latter can be diminished by having the lightning rod spread sideways as much as possible, either by rolling it into strips, or better, by making a network of rods over the roof with several connections to the earth at the corners, as I have before described.

Thus we see that the theory of lightning rods, which appeared so simple in the time of Franklin, is to-day a very complicated one and requires for its solution a very complete knowledge of the dynamics of electric currents. In the light of our present knowledge the frequent failure of the old system of rods is no mystery, for I doubt if there are a hundred buildings in the country, properly protected from lightning. With our modern advances, perfect protection might be guaranteed in all cases, if expense were no object.

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We have now considered the case of oscillations of electricity in a few cases, and can turn to that of steady currents. The closing of an electric current sends ethereal waves throughout space, but that after the first shock the current flows steadily without producing any more waves. However, the properties of the space around the wire have been permanently altered, as we have already seen. Let us now study these properties more in detail. I have before me a wire in which I can produce a powerful current of electricity and we have seen that the space around it has been so altered that a delicately suspended magnetic needle cannot remain quiet in all positions but stretches itself at right angles to the wire, the north pole tending to revolve around it in one direction and the south pole in the other. This is a very old experiment, but we now regard it as evidence that the properties of the space around the wire have been altered rather than that the wire acts on the magnet from a distance.

Put, now, a plate of glass around the wire, the latter being vertical and the former with its plane horizontal, and pass a powerful current through the wire. On now sprinkling iron filings on the plate they arrange themselves in circles around the wire and thus point out to us the celebrated lines of magnetic force of Faraday. Using two wires with currents in the same direction we get these other curves, and, testing the forces acting on the wire, we find that they are trying to move toward each other.

Again, pass the currents in the opposite directions and we get these other curves and the currents repel each other. If we assume that the lines of force are like rubber bands, which tend to shorten in the direction of their length and repel each other sideways, Faraday and Maxwell have shown that all magnetic attraction and repulsions are explained. The property which the presence of the electric current has conferred on the luminiferous ether is then one, by which it tends to shorten in one direction and spread out in the other two directions,

We have thus done away with action at a distance, and have accounted for magnetic attraction by a change in the intervening medium as Faraday partly did almost 50 years ago. For this change in the surrounding medium is as much a part of the electric current as anything that goes on within the wire.

To illustrate this tension along the lines of force, I have constructed this model which represents the section of a coil of wire with a bar of iron within it. The rubber bands represent the lines of force which pass around the coil and through the iron bar, as they have an easier passage through the iron than the air. As we draw the bar down and let it go, you see that it is drawn upward and oscillates around its position of equilibrium until friction brings it to rest. Here, again, I have a coil of wire with an iron bar within it with one end resting on the floor. As we pass the current and the lines of magnetic force form around the coil and pass through the iron, it is lifted upwards although it weighs 24 pounds and oscillates around its position of equilibrium exactly the same as though it were sustained by rubber bands as in the model. The rubber bands in this case are invisible to our eye, but our mental vision pictures them to us as lines of magnetic force in the luminiferous ether drawing the bar upward by their contractile force. This contractile force is no small quantity as it may amount, in some cases, to one or even two hundred pounds to the square inch, and thus rivals the greatest pressure which we use in our steam engines.

Thus the luminiferous ether is, to-day, a much more important factor in science than the air we breathe. We are constantly surrounded by the two, and the presence of the air is manifest to us all; we feel it, we hear by its aid and we even see it, under favorable circumstances, and the velocity of its motion as well as the amount of moisture it carries is a constant topic of conversation with mankind at large. The luminiferous ether, on the other hand, eludes all our senses and it is only with imagination, the eye of the mind, that its presence can be perceived. By its aid in conveying the vibrations we call light, we are enabled to see the world around us, and by its other motions which cause magnetism, the mariner steers his ship through the darkest night when the heavenly bodies are hid from view. When we speak in a telephone, the vibrations of the voice are carried forward to the distant point by waves in the luminiferous ether, there again to be resolved into the sound waves of the air. When we use the electric light to illuminate our streets, it is the luminiferous ether which conveys the energy along the wires as well as transmits it to our eye after it has assumed the form of light. We step upon an electric street car and feel it driven forward with the power of many horses, and again it is the luminiferous ether, whose immense force we have brought under our control and made to serve our purpose. No longer a feeble uncertain sort of medium, but a mighty power extending throughout all space and binding the whole universe together, so that it becomes a living unit in which no one portion can be changed without ultimately involving every other portion.

To this, ladies and gentlemen, we have been led by the study of electrical phenomena, and the ideas which I have set forth constitute the most modern views held by physicists with respect to electric currents.

* * The contracts for the construction of the Alameda avenue electric railway in Denver, Col., were signed Friday by the Thomson-Houston Electric Company, and grading will be commenced at once. The cost of constructing the entire road, which is three and a half miles long, will be $40,000. The agreement calls for the line to be in working order by August 15th.

Pittsburgh, Pa.—The Pittsburgh Electric Company, of Pittsburgh; capital, $10,000.

El Paso, Texas.—The El Paso Gas and Electric Power Company, of El Paso has been chartered; capital stock, $300,000.

Cairo, Ill.—The Cairo Electric Light and Power Company, of Cairo, Ill., filed a certificate of increase of capital stock from $10,000 to $25,000.

Pittsburgh, Pa.—The People's Light and Power Company has been incorporated by Willis L. Eaton, Theo. Kloman, and John E. Ridall. Capital stock, $10,000.

Chicago, Ill.—South Side Heat and Power Company, Chicago; to furnish heat and power; capital, $1,000,000; incorporators Thomas Martin, L. H. Bisbee, L. J. Pierson.

Oswego, N. Y.—The Oswego Fuel and Lighting Company. The incorporators, are John D. Brown of New York, Winfield Clark of Albany, and James F. Herrick of Oswego.

St. Paul, Minn.—The Thomson-Houston Electric Light and Power Company, of St. Paul; capital stock, $500,000. H. W. Turner, F. B. Fleetham and C. A. Daigh, incorporators.

New Orleans, La.—Samuel Logan, H. R. Giffey, Frank A. Pattison, J. H. Sullivan and others have chartered the Southern Electrical Manufacturing and Supply Company, Limited; capital stock, $50,000; to manufacture electrical machinery

San Francisco, Cal.—The Sunset Telephone-Telegraph Company, capital stock, $3,000,000, divided into 30,000 shares. Directors, George S. Ladd, John I. Sabin, William G. Oliver and Monroe Greenwood, of San Francisco; Percy T. Morgan, of Berkeley, David Gage, of Oakland.

New York.—The United Edison Manufacturing Company, of New York, capital, $100,000, has been incorporated with J. Hobart Herrick, Henry Gillard, Samuel Insull, J. Hood Wright, Charles E. Channock, Charles H. Coster, Francis R. Upton, Ed. H. Johnson, and C. A. Spefford as trustees.

Kansas City, Kan.—The Kentucky Zinc Mining Company; general officers at Kansas City, Kan., and Kansas City, Mo.; capital stock, $50,000, in shares of $1 each. Directors, William H. Moffit, Andrew C. Austin, Jno. N. Vimont and James K. Selleck, of Kansas City, Mo.; James C. Laughlin, Geo. W. Harden, Jr., and E. A. Guild, of Kansas City, Kan.

San Francisco, Cal.—Articles of incorporation of the Pacific Writing Telegraph Company were filed with county clerk. This is a re-incorporation of the Writing Telegraph Company under a new management. The directors are M. L. Hadley, H. W. Brown, John F. Murray, E. L. Campbell, L. W. Storrer, J. B. McChesney and Thomas H. Barry. The capital stock is fixed at $2,500,000.

Newark, N. J.—The New Jersey Asphalt Pavement and Conduit Company have recorded articles of incorporation in the county clerk's office. The incorporators are: Gottfried Krueger, Elias A. Wilkinson, Cyrus C. Currier, P. Sanford Ross and James E. Fleming, all of Newark. The place of business is Newark. The business is the manufacture of hydraulic and bituminous cements and their application in the construction of buildings, sub-structures, conduits for electric and waterways and pavements of all kinds. The capital is $100,000.

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We invite correspondence from Electricians, Inventors, and the Telegragh and Telephone fraternity and those engaged in Electric Lighting, on matters pertaining to electrical and scientific subjects, and all facts of special interest in connection therewith.

We extend to manufacturers of electrical apparatus an invitation to send to this office any and all facts concerning their business which will be of interest to the public. We make no charge for publishing news.

Subscribers can at any time have the mailing address of their paper changed by sending both old and new address.

NEW YORK, JUNE 8, 1889.

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The wonderful activity in the introduction of electric power for street railways throughout the country is keeping the supply companies crowded with orders. The query often arises, what will be the effect on the horse market of this substitution of electric for horse power on such a gigantic scale? But it should be remembered that this is a moving and progressive age, and as has been the case many times before, the sound old economic law of demand and supply will assert itself, and no alarming drop in the price of equine flesh is likely to follow.

Another of our cherished beliefs has been shattered by the onward march of science. A distinguished member of the Academy of Sciences, M. Jamsen, while observing a beam of electric light on the top of the Eiffel tower, from a distance of about five miles, discovered that the oxygen band in its spectrum was similar to the oxygen band in the suns rays. As the intervening atmosphere from the Meudon observatory to the Eiffel tower is about as great as the depth of the earth's atmosphere, it is argued that the apparent pressure of oxygen in the sun may be due to the oxygen in the earth's atmosphere.

It is proposed by M. Léon Roquet to get up a universal telegraphic language, in which often recurring words shall be designated symbolically by letters or figures which shall be the same for all languages. It is easy to see that such a plan if carried out would greatly facilitate international communication, yet it would be a task so difficult that few would care to undertake it.

It would be interesting to note the outcome of the experiment which is about to be tried at Rheinfelden on the Rhine of distributing electric power over a radius of 15 miles. Turbines aggregating 15,000 horsepower are to be erected at the above named town. Several dynamos, of 500,000 watts each (2,000 volts and 250 amperes), are to be coupled in series, it being proposed to work at a pressure of about 8,000 volts.

Our English namesake, in commenting on the subways of New York, says with charming simplicity: "The streets of New York are, as is well known, perfectly straight, and there is no difficulty whatever in having each manhole exactly in a line with those on each side of it." The writer of the above sentence should wander around a little in the lower part of the town and his dream would be banished forever.

As the investigation into the electric sugar fraud proceeds and the truth is being gradually divulged by the sure process of the law, one cannot but devoutly hope that this practical lesson may teach the public that the impossible has not been done away with by electricity. The spectacle of stockholders paying $30,000 for a case said to contain machinery but which really contained refined sugar, almost makes one doubt the limit of human credulity.

The interesting facts and theories on lightning discharges and concerning protection from lightning advanced by Professor Rowland in his paper on "Modern Views with Respect to Electric Currents," an abstract of which appears elsewhere in this issue, are particularly pertinent at this time, when, notwithstanding the earliness of the season, the destruction of much property by lightning and many fatal thunder storms have already been recorded.

Brooklyn property owners seem to care more for shade trees by day than for light by night; for sufficient pressure has been brought to bear on the police commisssoner to order the arrest of linemen who have cut a few limbs from shade trees in order to enable them to run their lines. Shade is good, but light is better, and anyone who is familiar with the careful electric light construction to be seen in the streets of Brooklyn will regret to see it discouraged.

It has often been a matter of surprise to those who remember the magnificent display of Jablochkoff lamps in Paris just at the beginning of the present decade, that this most beautiful city of Europe has practically been without electric lights in the streets for a number of years. The restrictive influence of "gas money" has done on a large scale for Paris what has been done in this country in hundreds of towns and cities that for years were deprived of the benefits of the electric light. We are pleased to learn that American apparatus has gained a foothold in Paris.

The case of the Interstate Telegraph Company against the Baltimore and Ohio Telegraph Company for $100,000 damages for alleged breach of contract was taken up Wednesday in the United States Circuit Court at Baltimore before Judges Bond and Morris and a jury. The bill of complaint alleges that an agreement was entered into between the two companies for a mutual interchange of facilities for extending business, and that the Interstate Company agreed to build lines in Indiana and Michigan, and that the Baltimore and Ohio Company agreed that if its lines should be sold the Interstate Company would be provided for according to the contract. The bill further alleges that the Baltimore and Ohio Telegraph Company did sell out and failed to carry out the latter part of the agreement.

AN ABASEMENT OF SCIENCE.

The scope of the punishment of criminals as a means for the preservation of law and order is two-fold in its nature—first, to prevent the criminal from further acts of lawlessness by confinement for a time, depriving him of liberty as being unworthy of the rights of a freeman; and secondly, by the information of the fact that this deprivation of rights is a sequence of such deeds and serves a purpose to deter other evil-minded persons from similar acts by a knowledge of the consequences. For the latter reason it is well to give proper publicity to the findings by juries and sentences by judges, as calling attention to the result of offences against the law, and these criminal reports actually serve good purposes notwithstanding that sentimentalists take umbrage at the stench of such untrapped sewage of human guile. Ignorance of the law excuses no one; it is a principle that all must know the law, while, as a matter of fact, no one knows the law, and if this truism includes the legal profession how far short must the generality of the community fall, especially those naturally forming a criminal class, but when the specific results of actual crimes are published in the usual course, the record of results following specific acts cannot but have a deterrant course on those prone to evil.

This statement of the objects of punishment does not fully apply to capital crimes, for in such cases the potentiality of the criminal would be terminated by a life imprisonment, but in the instance of capital crimes, the offence is so horrible and inhuman that the law takes the life of the malefactor—not to punish him, for the mystery of eternity is revealed in a few short struggles, probably far less painful than the inevitable termination of life which awaits all of us, but the execution takes place as the most impressive warning to all except the one who has expiated the capital offence.

Partly by design and partly by the logic of events, everything in connection with capital punishment is naturally loathsome and abhorrent to the sensibilities. The gallows are not used for anything but their legal purpose, and the hangman certainly does not fill an office of honor. In many instances by masks or concealment his personality is not known. It is not probable that anyone will question but that the method of hanging efficiently carries out the sentences of courts imposing capital punishments throughout the greater portion of the civilized globe.

Now suppose that some other means of capital punishment be adopted, such means would at once receive the prejudice and opprobry of the community.

Suppose that a criminal be sentenced to drowning in the reservoir of a public water works, the order of the court could be carried out without any deleterious contamination of the water supply, but who would believe it!

Sentence criminals to be bound on railroad tracks, and the great railway system of land commerce speedily bringing the resources of each part of the country at the disposal of all in a great and beneficent communism, would become as loathsome as the car of Juggernaut, and too horrible for contemplation.

Illuminating gas affords the most efficient known means for a speedy, certain and painless death, and is also unaccompanied by any disfigurement of the body.

Why multiply suggestions when every force of nature and each application of energy to the service of man will, under certain contingencies, also take the life of man. Every means for the ministering to life can also be used to take life.

There have been accidents in connection with hanging, but who knows the inevitable result, beyond peradventure, of the proposed application of electricity for capital punishment.

The relative safety of electrical apparatus can never be known until the results from suicide and purely mechanical causes like belting and from foolhardiness can be eliminated from the present records.

No one has authoritatively defined what electrical applications will surely cause death to mankind. There are crowds of witnesses who have testified that they have received with impunity shocks of every application of electricity, and if the gallows must go, let it not be followed by a method whose results are subject to such a degree of contingency as to contain an element of possibility of causing undue suffering without fatality.

Such a method of punishment in the face of the rare and variable conditions surrounding the accidental fatalities from electric lighting currents, does not form any precedent which relieves the electrical execution from the charge that it belongs to the "cruel and vindictive punishment" forbidden by the laws of every civilized nation on the globe.

Furthermore, it is not merely for the execution of the law that the charge of vindictiveness can be laid, but in the use of electricity for capital punishment.

The specific form of apparatus to be adopted is one of standard worth both in regard to the ingenious application of scientific principles in its construction, and also for the high reputation which it justly bears as an efficient and economical method of electrical illumination.

Beyond matters pertaining to the affairs of any one system of electric lighting, this method of electrical execution casts ignominy upon the whole of electrical science as applied to illumination, the representative industry of civilization, which calls to its service the ablest of human minds, puts to profitable use millions of invested capital, furnished to thousands of persons honest employment; and the result of this vast enterprise has served to furnish an illumination which is a terror to evil doers in cities, makes night travel agreeable, is a luxury at home, of utility in factories and a blessing in hospitals among the sick and maimed, in all places electric lights form the ideal of illumination, and it is an outrage upon every interest involved to substitute the dynamo for the gallows and the electrician for the hangman.

It is indeed late in the day to stop the results of such faulty legislation in the State of New York, but not too late to call up the sober second thought to prevent the enactment of similar laws in other States, believing that in course of time the Empire State will come to a realization of what appears to be a grave miscarriage of legislation and apply the just remedy of repeal.

Boston, May 24, 1889. C. J. H. W.

In his recent lecture before the Electric Club Mr. Wiman made a pertinent point that the combination of effort in business which is so largely aided and really made possible by electrical agencies, is not made use of as it should be in the electrical business itself.

To people interested in mechanics few places in Utica are of greater interest than the electric lighting station on Cornelia street, remarks the Utica *Herald*. The place is visited nightly by many sightseers. The plant has grown much since it was founded in 1887. It now has 15 dynamos for arc lights and two machines for incandescent lighting by the alternating current. The arc dynamos furnish currents for more than 400 lamps and the incandescent circuits now include about 1,700 lamps.

After removing 1,682 poles and 1,140 miles of overhead wires from the streets of New York City since January 1st, the Board of Electrical Control is not only beginning to stay its destroying hand, but actually granted, last week, a number of permits to the telephone and electric light companies to serve their customers in districts not yet provided with subways. This has been commented on by some of the daily papers as a sure index that His Honor, the Mayor, is guided by rightmindedness in his propensity for pole cutting. We are, however, unable as yet to see that the overhead wire question has received that calm deliberate treatment which so grave a subject demands.

THE GREAT EXHIBITION.

ELECTRICAL EXHIBITS AT THE PARIS EXPOSITION.

OUR SPECIAL CORRESPONDENT SENDS INTERESTING INFORMATION CONCERNING SOME OF AMERICA'S PROMINENT DISPLAYS.

I will confine myself in this letter to the American exhibits.

The Thomson International Electric Welding Company, of Boston, Mass., is represented by Mr. A. S. Garfield, of Boston. Their exhibit comprises three dynamos for electric welding, 70, 20 and 12 horse-power respectively, and two welding coils. This company proposes to weld any metal from the finest wire to two-inch wrought iron shafting.

The exhibit of the Thomson-Houston International Electric Company, of Boston, is in connection with that of the above-mentioned company, and is in charge of Mr. E. Thurñauer. They will have a very attractive exhibit. Three switchboards handsomely decorated with incandescent lights, which will produce a brilliant electrical effect are shown, besides two alternating current dynamos which furnish light and power for experimental work in the industrial section of the Exposition, and three small incandescent dynamos. By no means the least important part of their exhibit is an 80 horse-power dynamo which transmits force to a motor in the agricultural section, nearly a mile away, which in turn drives a dynamo at 220 volts, and these 220 volts are distributed on two circuits of 110 volts each, the potential being kept constant in each by Professor Thomson's new equalizer. This dynamo furnishes power for the American section. The company also supplies power and light to other of the exhibits in different sections.

The Edison exhibit is not only the largest in the United States section of machinery palace, but is larger than any other in the whole Exposition. It covers 9,000 square feet, which includes the large exhibit in machinery palace, and the phonograph pavilion in the industrial section. It fronts on the main aisles, is divided into sections inclosed by railings, which will be hung with velvet cord. In the center of the space between the posts at the crossing of the cord is a medallion of the letter "E," surrounded by four lamps. On the top of each post a lamp is placed.

The Edison municipal system of lighting is in operation and assists in the lighting of the exhibit. That which first attracts the eye of the visitor on entering the palace from Avenue de la Boardamais is a large incandescent lamp and socket. It represents the ordinary lamp magnified 20,000 times. It crowns a pedestal, the whole being 40 feet in height. On the front of the small pedestal—the immediate support of the lamp—is a bust of Edison in a recess, surrounded by incandescent lights, the whole illuminated from the interior. On the opposite side to the bust is a star, on one of the sides the letters "U. S." one over the other, and on the opposite side the letters "R. F." arranged in the same manner. On the front of the base will be grouped two American flags with the words "Paris, 1889, Edison." On one side appears a shield, and on the other grouped flags. Crowning all, at the foot of the socket, is an American eagle, supported by a shield around which are grouped the Stars and Stripes. This elaborate monument is fairly ablaze with light, exhibiting some novel electrical effects. The telegraphic section contains working models of all of Edison's inventions in connection with telegraphy. There are models of the quadruplex, duplex and phonoplex, train—or "grasshopper" telegraph, gold and stock, private line printers, harmonic, district messenger system, the automatic and autographic telegraph, the motographic translator and repeater, and various other instruments, such as carbon relay, carbon rheostat and motograph relay. Separating the telegraphic department from the physical is a zigzag railing, and on the side of the panels facing the former are painted models of instruments in the telegraphic department, while on the opposite side appear models of the physical exhibit. This display includes the electric pen, mimæograph, water bridge, magnetic bridge, lamp bridge, phenomena in incandescent lamps, condenser lamps – motographic principle, and various apparatus showing its application, his tasimeter, odoroscope, dead-beat galvanometer, etc. We now cross the first side aisle and enter the electric lighting department. Here are displayed a section of underground tubing such as is employed in America, a complete working model of the Edison three-wire central station system, a complete isolated plant and the municipal plant for street lighting, a No. 56 Edison dynamo which generates a current of 1,250 amperes, and a small one of a similar type of 23 amperes.

On the front of the partition which divides this department is displayed to the very best advantage, complete appurtenances of the systems of electric lighting referred to including instruments for indicating the pressure and volume of electricity, and devices for regulating and controlling the same. On the opposite side is a large painting, 20x12 feet, representing in a striking manner the birth and world-wide use of the electric light. In the center is seen Mr. Edison's laboratory at Menlo Park, and surrounding it are scenes from every corner of the globe, where the light is used. There is a representation of the palace of the King of Siam, the Houses of Parliament, the Produce Exchange in New York, a factory in Finland, the interior of a South American palace, a theater in Milan, Italy, and one of the French public buildings. Rising from the roof of the laboratory spectre-like, and shedding its rays into each of the scenes depicted, is a huge incandescent lamp.

It is, moreover, a model meter department, displaying meters such as are used in their large stations in America, as well as various models of the experimental meters of Mr. Edison's invention. Adjoining this department is a huge model of the magnetic ore separator in operation. We now cross the second aisle to the phonographic and telephonic pavilion. In the space surrounding this pavilion are displayed models of the telephone from the first machine to the latest improved, and also models of the phonograph, the first machine ever made by Mr. Edison being included. The walls of the pavilion are nearly a foot thick in order to keep out the noise of the machinery. It will be handsomely furnished, and contain one of the best pianos to be found in Paris. It will be used exclusively for the reception and entertainment of distinguished guests, who may desire to become acquainted with the working of the telephone and phonograph, both in a conversational way and in connection with the piano. Arising from the roof will be a huge Japanese umbrella, which will be kept constantly in motion, the rim being lined with incandescent lamps, arranged to produce most beautiful effects. Above the door is a painting of the perfected phonograph, and at each side is a show case on which will be perched two blinking owls. This portion of the Edison exhibit is designed to be its crowning feature.

In the electric exhibit of the industrial section is the graphophone, represented by Mr. Percival Lee Waters; a number of instruments are on exhibition, and they are well patronized by a highly amused public. Mr. Waters arrived quite recently only to find everything in confusion, but has managed in a short time to get order out of chaos, and when the decorations are completed will have a very handsome display.

The American Bell Telephone Company is represented by the genial Mr. W. D. Sargent, who is here as much, if not more, for the benefit of his health, as to take charge of the exhibit of the Bell Company, and expects to return to America in July, leaving Mr. J. D. Bishop to look after the company's interests. This exhibit is in the United States industrial section and consists of an original and *fac simile* of the finest talking telephone instrument invented by Professor Bell, showing the birth, progress and present development of telephony in the United States, including the most improved form of long-distance apparatus now in use connecting the cities of New York, Boston, Philadelphia, Providence, etc. Mr. Sargent informed me that it was his intention to connect the offices of the United States Commission with each other through a switchboard located in their space, and if possible, to run a wire from the Bourse to their exhibit. They may encounter difficulties, however, as the running of wires overhead is practically prohibited, and moreover the interests of the French telephone companies must be consulted, and anything that detracts from the French system will hardly be permitted.

The space occupied by the Bell Company is one of the most conspicuous in the section. It is surrounded with a railing, nicely carpeted, and in the center potted flowers are displayed in profusion, and in one corner in full view of the passing multitude, a life size portrait of Professor Bell. There is ample accommodation for the many friends of the company and its genial manager, who may be in Paris during the Exposition. The top section of an 80 foot pole for the long distance telephone, is exhibited.

The Western Electric Company, of Chicago and New York, has an exhibit in charge of Mr. J. D. Bishop, who at the same time is one of the representatives of the Bell Company, and who will take charge of the latter company's exhibit on the return of Mr. Sargent. Mr. Bishop arrived when everything was chaos, and has superintended the installation of the exhibits of both companies. His company manufactures, I am assured, all the telephone apparatus and telephones in the United States, supplying the Bell Company with all its requisites. Their exhibit consists of cables, cable terminals, hotel and house annunciators, with all the necessary paraphernalia, besides their electric light system with all its improvements.

G. M. B.

Paris, May 27th, 1889.

OUR CHICAGO LETTER.

Central Union.—Telephone stock seem to be on an upward boom. Central Union is flying at 54 to 60 bid and asked.

Storms.—These have been the special order of the day, through the past week, and all over the West. It has rained as if the everlasting bung was out, and been cold enough to give chickens the asthma. Lightning has been dancing round the outskirts, doing its little mean tricks, as if in a spirit of spite work at Harold Brown and the New York commission.

Near Corydon, Ind., on the day before Decoration day, five persons riding in a wagon were stunned by a bolt of lighting, which instantly killed the sixth who was the driver's wife. The wagon was converted into kindling wood, and one horse was killed.

Telegraph School Episode.—There was a telegraph school at Morgan Park. An indictment was found by the grand jury against the proprietor, last week, on complaint of the learned Pundit's victims.

Victim paid $50 as security that he would take a course of instruction at Pundit's school. The victim denies that the instruction comes up to the grade promised and wants his money back. Pundit couldn't see it and the result is an indictment—the second of the kind against the Pundit—for obtaining money under false pretences. That class of telegraph colleges is rare in Chicago now. It proved disastrous to their business when a policeman was stationed at the down stairs entrance—they were always on upper floors—and said to the little flies as they drew near the spiders web—"run away home now little girl" or boy, as the case might be. "The telegraph college is a blankety blank swindle, so to speak," and the business didn't somehow prosper under that style of recommendation.

Motors for Rent.—D. Dichington, C. A. Robinson and M. D. Black are the incorporators of the Electric Motor Renting Company, just formed here, the purpose of which is to purchase or lease electric motors, dynamos and other machinery. Capital, $30,000.

Additional Plant.—The Englewood Electric Light Company has just started up an addition to its original plant of 1,500 Westinghouse incandescent machinery and lamps, which, added to the 750 already in, makes 2,250 lamp capacity.

C. C. H.

Chicago, June 1, 1889.

PERSONAL.

Mr. Wm. Heisler, president of the Heisler Electric Light Company, goes to Paris, France, in a few days to give his exhibit there his personal attention.

Mr. H. D. Stanley and Mr. Cyrus O. Baker, Jr., were seen in the classic thoroughfares of Boston last week, and received hearty greetings on all sides.

Mr. S. A. Barton, the popular general manager of the Thomson-Houston Company, with headquarters at Chicago, has been on an eastern trip during the past two weeks.

We learn that Dr. Robert Amory, manager of the Boston Telephone Exchange, has been granted leave of absence for the summer months, and that he will take his vacation at Bar Harbor, Me.

The office of Mr. W. H. Cole, the well-known consulting electrician and engineer, has been moved to 321 East 14th street. Mr. Cole is also the sole agent of the Phœnix Incandescent Lamp Company.

President D. C. Middleton, of the Watertown Electric Light Company, publishes a letter in the Watertown *Daily Times* defining his company's position in the controversy there concerning the granting of more light franchises.

Mr. A. R. Foote, the well-known electrician and author of Cincinnati, was in town last week. The hard work being done by Mr. Foote as chairman of the committee on State and municipal legislation of the National Electric Light Association, is sure of bearing good fruit.

Mr. F. H. Hayward, of the energetic firm of Williams & Potter, constructing engineers and contractors and general agents of the Straight-Line engine, has left for Paris, where he will represent the firm and look after the Straight-Line engine interests at the Paris Exposition.

Mr. George M. Meyers, prominently connected with telegraphic interests and electrical affairs in Kansas, with headquarters at Kansas City, passed through the city last week *en route* for Europe where he will join the rapidly increasing colony of electricians and scientific men at the Paris Exposition.

Mr. Henry D. Hall, of the Empire City Electric Company, has just returned from a pleasant trip east extending as far as Boston, and brings back word that the business outlook in the electrical field in that part of the country is very bright, and that the Empire City Company has not been at all forgotten by its many eastern friends.

Mr. J. T. Moriarty has given up the New England agency of the Electrical Accumulator Company, of New York, and the Holtzer & Cabot Electric Company, which was recently incorporated with $55,000 capital has become licensee of the Electrical Accumulator Company, for Massachusetts, New Hampshire and Vermont.

Mr. Frank Ridlon finds the business in which he has embarked, of handling second-hand electric apparatus, a steadily increasing one. In addition to the electrical specialties, the bric-a-brac department is not neglected, and Frank now informs us he has a church organ on hand, all ready to be blown by electric power, and is prepared to quote very lowest prices on an orthodox pulpit, warranted sound.

Agent Rowley of the Thomson-Houston Electric Light Company of Boston was severely injured by the elevator at Shepard & Co.'s dry goods store, Westminster street, Providence, last week. His head was caught between the car and a beam and his jaw was mangled and throat gashed. Agent Rowley was looking at the electric appliances, when somebody carelessly started the machinery and the car pinioned him. He is now under surgical care.

*** Public long distance telephone offices have been opened in Providence.

*** Monday the Southern New England Telephone Company began the handling of their entire business of the New Haven division from their new and specially arranged building on Court street The switchboard upon which the connections are made is not only the most complete one in New England but in the United States. It is so constructed that a single operator, without moving or speaking, has control of every line coming into the building. The whole system has been brought about through the arrangements of Superintendent E. B. Baker. The trunk line operators and long distance operators are by themselves.

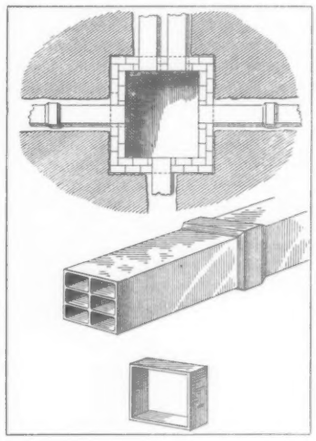
*** The Bell Telephone Company waived all dividends on its 30 per cent. interest in the Northwestern division of the Erie Telephone Company until January 1, 1890. When the Bell Company comes in for its share in these earnings the four per cent. dividend now being paid by the Erie Company will be reduced. Some estimate the reduction at one half the present dividend rate and others at one-quarter. The Bell contracts with the Cleveland and Southwestern divisions of the Erie Company also expire soon, and the Bell Company will probably ask for not less than a 30 per cent. stock interest in this business with no waiving of dividend rights.

*** In the early days of the telephone many amusing things occurred. D. F. Bremner, the wealthy West Side baker, of Chicago, tells a story illustrative of this. A man came in one day who had been formerly in his employment. He said his wife was very sick at home, close by, and that he wanted to telephone to his wife's sister to come home at once. Permission was granted. The man stepped up to the instrument, Then without ringing up the central station and getting connection, without taking down the ear tube, he just hallooed into the hole: "Kitty, come home! Mary's sick!" and vanished before anybody could stop him. It turned out later that Kitty was not even to be reached by telephone, there being none at the place where she worked, but the man had thought all he had to do was to speak into the instrument and it would carry the message anywhere he desired.

*** Beginning with the first day of June, the Southern New England Telephone Company issues tickets for the use of those who are not subscribers to the exchanges of the company. The company has found that there are a good many people to whom the occasional use of the telephone is a great convenience, for which they are willing to pay a small fee. Now the only way that they can avail themselves of the conveniences of the service is to ask the use of their neighbor's instrument, thus bothering the neighbor and taking from the company that for which they do not pay. These tickets allow the holder one local communication from any subscriber's station, where the subscriber is willing to let the instrument be used. The tickets will cost 10 cents each in strips of five, and when the holder of the ticket uses an instrument he will leave a ticket with the subscriber whose instrument he uses. This ticket the company will redeem as five cents cash in the settlement of its bills with that subscriber. Thus the company receives a small fee for the service that it renders and the subscriber receives a small compensation for the accommodation that his instrument has been to the user of the ticket. The company is also testing several devices on the plan of "put in your nickel and take out a bun," for the automatic combination of payment and access to the telephone.

Another New Conduit.

Among the electric subways which have passed the experimental stage, is the one illustrated in this number of THE REVIEW. It is known as the "Lake Conduit," and is the invention of John Lynch and Wilmot Lake of Washington, D.C. Mr. Lynch is the president of the terra cotta works where the conduit is manufactured, and Mr. Lake is the contractor who has the exclusive right to lay it. The glazed terra cotta of which it is made has the merit of not being liable to deterioration, and it contains nothing that can injure electric conductors or their coverings. It also has sufficient strength to withstand heavy street traffic, even when laid only a few inches under the pavement, as has been demonstrated in Washington, where it is used exclusively by the United



THE LAKE CONDUIT.

States Electric Lighting Company. The illustrations show the construction and manner of laying. The sections are two feet in length, each compartment measures 2½ x 4½ inches, and the walls are one inch thick. A collar of terra cotta is cemented around the joints. The entire conduit is imbedded in a casing of broken stone and cement three inches thick, which strengthens, protects and renders it impervious to water. Brick manholes of suitable size are placed wherever necessary to run branches to lamp-posts, buildings, etc. Drainage is provided for and ventilation is secured through the hollow iron lamp posts. Where more than six compartments are needed parallel lines are laid in the same trench. Being placed near the surface of the ground, it is quickly laid, with comparatively little disturbance to the street, and the running in and splicing of wires is a simple operation. The Washington Lighting Company laid some sections of this conduit about two years ago, and has found it so satisfactory that it has used it in all its subsequent work. Mr. Lake is now making extensive additions to its underground system.

A New System of Police Call.

Superintendent Kleinsteuber of the Milwaukee, Wis., police alarm telegraph, has just patented an invention which he claims will find a policeman when wanted, and an experiment is to be made. The invention includes an electrical clock apparatus, and the machine is to be put on the lampost at the northwest corner of Grand avenue and West Water street, immediately over and connected with the police patrol box. The invention is such as to work night and day, and is operated entirely by an electric button in the electric room at the police station. By touching the button in the station, four "white wings" are drawn out and displayed, a signal to the officer in the vicinity that he is wanted, so that he can immediately telephone from the patrol box to the station for instructions.

By night a red globe is made to rise and inclose the light of the lamppost—thus displaying a signal which can be seen several blocks away, indicating like the day signal that the officer is wanted at the telephone for instructions. Then when the officer has received his orders the same button in the central station is touched and the apparatus resumes its original place. While the invention might be a valuable addition to the police alarm system it is intended to be more applicable to railroads, where it can be made to work automatically and indicate a misplaced switch either by day or by night, the signal to be so plain as to give the engineer plenty of opportunity to stop his engine in time to avoid accident. Even should the switch be purposely misplaced and the wires to the signal be tampered with, the signal, which it is intended to erect on high poles out of any one's reach, would immediately show that the wires had been cut.

The Tobin Bronze.

This new alloy of copper, to which the inventor and patentee, P. A. Engineer John A. Tobin, U. S. Navy, has given his name, considering the brief period for which it has been in the market, has attained a remarkable commercial success. It is produced by the Ansonia Brass and Copper Company (whose endorsement is essential guarantee of the merit of a new metal) at its extensive works in Connecticut, and is rapidly securing the first place among alloys of its type. It is turned out in the shape of sheets and plates, rods and wire, seamless tubes up to two inches diameter, and ingots of three standards of quality. It possesses those distinctive characteristics, great tensile strength—about equal to that of the best mild steel, remarkable rigidity and toughness and—when forged, rolled or stamped at a dark red heat—as homogeneous a nature as the best artistic bronze, which make it available for an extremely large and varied number of purposes. From violin pegs to ship sheathing, or torpedo boat hulls, is certainly an extended range of usefulness, especially when this range comprises such an incongrous detail as agricultural implements and gunpowder tools, journal boxes, bearings and pinions and propeller blades, valve fixtures and gun mountings, for all of which purposes it is particularly suited.

The Tobin bronze is practically non-corrosive, though, when exposed for any considerable time on a ship's bottom, it has just that minimum degree of exfoliation which is requisite to assure a surface clear of barnacles. The Navy Department has already adopted it for certain features of the machinery and fittings of the new cruisers, its resistance to climatic and oxydizing influences rendering it valuable for a variety of uses on shipboard. Since the reagitation of the question of copper sheathing for the new vessels of the navy, which has received a strong impetus from the strong argument in its favor embodied in Constructor Hichborn's paper read before the Naval Institute early this month, attention is being given to the superior adaptability of the Tobin alloy to the metal ordinarily used for the purpose. The frequent dockings already required by the two new cruisers, "Boston" and "Atlanta," have demonstrated the costly incidents of keeping steel bottoms in anything like fit condition for satisfactory speed performance, and if the vessels are to do the years of service expected of them it may be found out in the end that hulls of such metal as the Tobin bronze below the water line, would have been true economy at the start. In strength, rigidity and toughness this metal is practically equal to the steel plates used, while its peculiar anti-corrosive qualities would assure it a much longer life than they seem likely to have. Certainly for the class of smaller craft, torpedo boats, steam yachts and launches, where the superior cost over steel is less operative, the Tobin bronze has undeniable claims. We know of one instance already in which it is being favorably considered for the hull plating, the vessel being a torpedo boat of new design, which will probably be built for a well-known inventor and a syndicate of New York capitalists.

The Phonopore.

The instrument called the phonopore, recently invented and perfected by Mr. Landon-Davies, of England, is an advance in electrical science. For several months past the new system has been undergoing a practical every day working test on a telegraph line of the Midland Railway, and its reliability from a commercial point of view is thought to be established. The invention was suggested by the well-known fact that if a telephone be inserted in a wire situated near to a line of telegraph wires, every passing current will produce noises in the telephone, notwithstanding that the telephone wire is perfectly insulated from the telegraph wires. The study of these noises, known as "induction noises," with a view to their prevention, led Mr. Langdon-Davies to conclude that induction is caused by some form of electrical force which may be separated from currents and which passes freely through insulations impassable to currents. This being the case, it would follow that a new series of instruments might be constructed for the utilization of this force, instruments that would be capable of being put in operation in company with "current" instruments on the same wire. Such instruments have been devised, and, according to the London *Times*, they not only supply a new system "of the highest practical ability," but they also add "a distinct and ind pendent chapter to the history of electrical development." As the only form of electrical force that finds free passage through these instruments appears to be always associated with sound, Mr. Langdon-Davies denominates the force with which he deals, the "phonoporic impulse," and his instrument the "phonopore." The phonoporic transmitter resembles, externally, an ordinary Morse key, mounted on a base four inches high, containing an instrument resembling an induction coil. The impulses are generated in a specially constructed primary circuit, over which is wound, in place of a secondary circuit, a phonopore, consisting of two wires insulated from each other throughout their whole length and at both ends. Each of these wires is connected, however, at one end to the line. The phonoporic instruments, it should be observed, have no conducting circuit through them. The phonopore is susceptible to electrical effects capable of being associated with sound, but does not permit the passage of electric currents. The number of phonoporic impulses generated per second in the transmitter is regulated by the vibrations of an organ reed placed in the primary circuit. As a receiver at the distant station is another reed, turned to the same rate of vibration, placed in front of an electro-magnet, and the phonoporic impulses from the transmitter cause this second reed to vibrate. A contact-breaker operated by the receiver reed completes a local relay circuit when the reed is still, but breaks it when the reed vibrates at its proper rate, thereby setting in action any required instrument in connection with a battery. To the eye of the ordinary observer the phonopore presents itself as a small apparatus consisting only of a pair of insulated copper wires. The practical utility of the invention lies, to a great extent, in the fact that it multiplies greatly the number of messages that may be sent over one wire. In a case where there is a great increase of business between two towns the exigency can be met by simply attaching a phonopore to the line at each end, without in any way altering the existing instruments, batteries or line. The phonopore can be worked at the same time as the ordinary telegraph instruments, and in the same or opposite directions. One line is thus made to do the work of two. If the line is already duplexed the phonopore will quadruplex it. If it is already quadruplexed the phonopore will sextuplex or octuplex it. There seems, in fact, to be no limit to the multiplex-carrying capacity of the new system. The phonopore is not dependent upon the ordinary telegraph instrument for its working. A message may be sent by the phonoporic instrument alone, or one or two may be sent at the same time with a telegraphic message. The messages are printed in Morse signals.

The Miner's Lamp.

The *Electrical Engineer* (London) has the following interesting editorial on lamps for mining purposes :

The conversazione of the Royal Society not infrequently brings into notice apparatus of a very interesting character, and more especially devised for use in purely experimental work. Occasionally, however, apparatus of wider utility is shown, and that seems to have been the case this year, when Pitkin and Niblett's gas detectors were shown. The miner's life at its best is a hard one, the dangers he braves and the work he does are but inadequately rewarded. There is a vast and profitable field for the use of any invention that will assist to ease the labor and reduce the danger. Such an invention many see in the application of electricity to miners' lamps. The requirements of a perfect miner's lamp, however, are not easily met, and work in the direction of supplying such lamps has not moved proportionately to the supply of electrical apparatus for lighting purposes in other directions, such, for example, as ship lighting. The miner's lamp must be cheap, not too heavy, certain in its action, capable of giving its light over a long period of time, safe from the possibility of igniting the firedamp, and able to indicate the presence of inflammable gases in dangerous quantities.

A number of lamps, actuated by primary or secondary batteries, have been devised, but none so far possess all the requisite qualities to enable one to say, this is the ideal lamp. Some of those in the market are ingenious and beautiful productions. Mr. Swan, seeing the absolute necessity of a gas detector, has added such to his lamp, but it has one great objection in that it is not automatic in its action. The miner at the face of the coal has to leave off his work and manipulate the apparatus in order to see the state of the air in the working. As a matter of fact, the men cannot be expected to do this; their whole attention is required by their work, and time cannot be wasted in manipulating even the simplest apparatus. Otherwise, we have looked upon Mr. Swan's device as exceedingly ingenious. Whether Messrs. Pitkin and Niblett have solved the question, we cannot say—to our mind the arrangement promises fairly—and we should require to know the results of a number of crucial experiments before giving adhesion to its perfection. The inventors are more deeply interested in studying the instrument than any outsiders, and may, perhaps, at once be able to answer satisfactorily the questions which arise. In the first place, the instrument consists of two thermometers, one of which gives the ordinary reading due to the temperature of the air in contact with the bulb, the other gives a reading due to heat development caused by the gaseous mixture in which it is placed acting upon spongy platinum or some similar metal—the precise chemist might say, through the action of the spongy platinum bringing about chemical combinations of some of the constituents of the mixture. Platinum has a remarkable power of causing the combination of oxygen with hydrogen and other combustible gases. "This property is exhibited even by a clean surface of platinum, in a greater degree by platinum in the spongy state, and most of all by the extremely divided form of the metal called platinum-black," *vide* Watts' Dict., vol. iv., p. 665. Now, if one of the thermometer bulbs is coated with platinum-black, and the platinum-black has the power to cause the combination of oxygen with the inflammable gas in a mine, thereby heating the platinum-black, the mercury will rise in the thermometer. If the heating thus effected is in proportion to the percentage of inflammable gas, then the rise of mercury will be proportional to that percentage. At this point an exceedingly grave question comes in. We assume that up to a certain point the heat of combination is used in heating the metals, and will not tend to ignite the surrounding inflammable mixture—in fact, that the spongy platinum acts like the gauze of a Davy lamp; but is not a point soon reached, when the temperature of the small quantity of spongy platinum used is sufficiently high to cause general combination. In other words, does it not again act like a Davy lamp, which, as is well known, may get too hot to be safe? Then, again, it must be ascertained whether the spongy platinum deteriorates in action, or whether it gets tired, and how, if it gets tired, the fact may be known to the lamp-minder. Again, is its action continuous—that is, if placed in a mixture, will it continuously indicate the presence of the adulterant gas, or will it indicate but momentarily or shortly?

The instrument can be made in a variety of forms. A suggested use, which commends itself to us, if the above questions are answered satisfactorily, is to fix it behind the incandescent lamp of the miner's lamp, making the dial of the instrument the reflector of the lamp, with the dark pointer across the dial. Every glance at the lamp would show the position of the pointer and condition of the mine. A small bell could also be affixed to the lamp, and when mercury or pointer came to "danger signal," contact could be made, and the bell would ring out its warning sound. This might prove more useful than a pointer, because the miner might be too intent on his work to notice the position of the pointer, or a sudden influx of gas cause danger when a moment before there was no danger. The ringing of the bell would hardly fail to attract attention.

We have still one more question to ask. It is evident the action of this instrument is limited in range. Taking it that the inflammable gas in a mine is marsh gas (CH_4) and that it requires ten times its volume of air to cause an explosive mixture, or, as the miner would put it, five volumes to become dangerous, the range required through which an instrument must be effective, is soon ascertained. Have the inventors determined the range? These are a few of the questions which present themselves upon the introduction of this instrument. For the sake of the miners we sincerely hope that it is perfect, or can be made perfect. Combined with an electric lamp, it would give a more effective lamp than any at present used, and the introduction of such a combination into our mines would be exceedingly rapid. It must not be for a moment supposed that miners or owners object to the introduction of better lighting. They do not; both men and masters are anxious for it, but they will not accept the imperfect lamps that have hitherto been put forward as substitutes for the Davy, Clany, or other forms.

.... District Manager Lawton, of the Southern Postal Telegraph Co., is looking after the extensive building operations of his company in South Carolina.

.... It is stated that at the end of 1888 the number of telephone trunk wires in Germany amounted to 166, having a total length of 10,607 kilometres, and over which a daily average of 28,099 messages were sent. The longest line is that between Berlin and Breslau, which attains a length of of 348 kilometres, and over which some 100 messages pass every day. The Hamburg-Lubeck line is the busiest, having a daily average of 390 conversations, the Bremen-Bremerhaven wire coming next with 276 conversations per diem. The authorities have decided to erect 12 additional trunk lines during the current year.

.... The Milwaukee, Wis., Telegraph Company intends to extend its system of electric lights and has petitioned the Board of Public Works for permission to lay a cable across the Milwaukee River to the East Side. Some legal questions were raised by the petition, and City Attorney Elliot was asked for an opinion. He held that the company, having the permission of the property owners on both sides of the river, could lay a cable, if it did not form an obstruction to navigation, and the board could neither grant a permit for it nor stop it. The cable is to be put two feet under the bottom of the river.

The Copper Situation.

Bradstreets has the following on the copper situation :

Copper is to be sold at 12 cents a pound until July 1st by the companies which entered into the agreement. Whether that price will continue longer depends upon circumstances. The understanding already arrived at covers, it seems, only this month and next. The agreement has not strengthened the market materially, both traders and consumers still regarding the outlook as uncertain. A similar pool existed formerly, but went to pieces because certain members were able to realize handsome profits at much lower prices than those which had been agreed on, and saw no reason to continue sacrificing their own interests for the benefit of their weaker competitors. History may repeat itself in this particular. It cost the Tamarack Company last year 5¾ cents per pound to produce and market its copper. At 12 cents, therefore, the profit is at least 100 per cent. There are other companies which can do as well. Harmony among the producers must accordingly be regarded as a rather uncertain quantity.

Nine of the leading Lake Superior companies produced 17,427 tons of copper between January 1 and May 1, against 15,814 tons last year. The Calumet & Hecla output rose from 8,787 to 10,374 tons.

Nothing was done at the recent conference in the direction of co-operation with the European owners of copper. The French and English bankers now have their own problem to contend with, and the American mine owners theirs. The European stock of the metal is understood to be about 175,000 tons and the American stock 40,000 tons. The owners of the stock and the mines on this side of the water are protected by a duty of four cents a pound on imports There is little, if any, reason to anticipate either imports of copper of foreign production or reimports of American stock now held abroad. Consumers in this country will accordingly pay 12 cents a pound or thereabouts for their supplies, taking for a basis the combination terms, while European consumers get their metal for eight cents to nine cents a pound. Before the French syndicate took the field the domestic price was in the neighborhood of 10 cents. While the companies may maintain the 12 cents ratio for the present, an early decline to the former level would probably excite no great surprise. The European holders, like the American, it is understood, are endeavoring to sustain the market by price limits and restriction of sales, very much after the plan that has been developed here.

... It is reported that electricians working for the Edison Company at Gilbert's mines in Bechtelville, Berks County, Pa., have invented a wire fishing-rod with an electric bell which will ring for every nibble.

.... There was a large attendance at the hearing of the Malden, Mass., Electric Light and New England Telephone companies before the Malden board of aldermen Wednesday evening. The special matter under consideration was the petition of the electric light company to erect additional poles in order to prevent the disturbance of the telephone service by the electric light wires. No decision was arrived at, but it is quite probable that a settlement of the difficulty will be effected, as both companies seem amicably disposed.

.... The bill before the Mass. legislature in relation to the taxation of telegraph companies came up for a third reading. It provides for the taxing of miles of wire instead of miles of line. Mr. Gleason, of Plymouth, opposed the bill, which he said would retard progress, especially in the building of short lines to seashore resorts. Mr. Kingsley, of Middlesex, thought that if any such legislation was going to be enacted, it should be made to apply to railroads as well as to telegraph wires. On motion of Mr. Symonds, of Essex, the matter was referred to the next General Court.

TELEGRAPHIC

.... The Western Union Telegraph Company has sent 15 men to Pond Creek, I. T., to begin work at once on a telegraph line to Kingfisher, Oklahoma.

.... The Robinson-Foster Company has been granted permission to locate poles, wires, etc., in the city of Newburyport, Mass., for the purpose of furnishing electricity for motive power.

.... The International Telegraph, District and Construction Co, of Baltimore city, placed on record Saturday a mortgage covering all its property, rights and franchise to the Mercantile Trust and Deposit Company to secure issue of $75,000 in bonds, 50 for $1,000 each, 96 at $250 each and 10 for $100 each, at six per cent. interest, redeemable in 1909.

... When the janitor of the Western Insurance Company's building in Pittsburgh, Pa., closed up the office one evening, he locked in two young girls, who work on the upper floor, but had not left at the usual time. The girls discovered their predicament some time later, and became badly frightened at the prospect of spending the night in the building. After a few hours had been wasted screaming at the top of their voices to attract the attention of passers-by, one of the young ladies thought of the telephone in the building. She called up the police department, and an officer released them.

... The fight between the bucket shops and the Board of Trade in Chicago has been renewed. Bailey, Willis & Company, who have an office outside of the board and who have been securing quotations from a "ticker," began an action against the Board of Trade, the Western Union Telegraph Company and Gold and Stock Telegraph Co. alleging that the Board of Trade's claim of exclusive jurisdiction over its quotations is untenable, and therefore the contract with the telegraph companies, which recognizes such a right, is not valid. Judge Tulley granted a temporary injunction restraining the telegraph companies from removing the "tickers."

.... The fire alarm protective chart, with key attached, has been patented by an ingenious citizen of Chicago. It consists of a small tin chart, with the location of the nearest box and instructions how to use the key and the number of the box printed upon it. It is proposed to place these keys with as many householders as possible in each fire district of the city. When a fire is discovered the discoverer will then be able to locate immediately the nearest fire alarm box and turn in the alarm. As it is now, the locations of the boxes are known to very few, and still fewer know how to work them when found. Consequently, a fire generally gains good headway before the department is notified, and considerable loss is in this manner incurred.

.... An electrical shoal-water indicator has been devised by two Mexican inventors. It consists of a strong cylinder filled with shot, so that when hung by a cable from a ship it will remain perfectly upright in the water. Embedded in its center is a glass or vulcanite tube half full of mercury, the two ends being closed by metallic plates, which are in communication, by insulated wires carried by the cable, with an electric battery and bell on the deck of the ship. The action of the apparatus is as follows: When the vessel approaches shallow water the cylinder drags on the ground below, and is consequently no longer upright, but is thrown on its side. This causes the mercury in the tube to touch both the metallic plates attached to that tube, as above explained; the electrical circuit thus becomes complete, and the warning bell on the ship instantly rings.

* * Chattanooga's electric railway is to be extended and work has already begun on the new road which will be pushed to the utmost.

* * The opponents of electric railways in the streets of Cleveland, O., received a very serious set-back in the city council recently.

* * The South Side railway at Cleveland, Ohio, have just received the new equipment of electric cars, all of the highest type of the John Stephenson Company's work, fitted up with motors and appliances in Thomson-Houston Company's superior style.

* * The electric street railway at Bangor, Me., the first of the kind east of Boston, is now all ready for business, and Saturday for the first time a car was run and fares taken. The long delay has been due not to electrical difficulties but to those purely mechanical.

* * We desire to testify that in our opinion the edition of May 3d of our esteemed contemporary, *Engineering*, of London, for scientific, mechanical and engineering news, stands almost without a parallel in the history of journalism, covering the fields named. Its description of the International Exhibition at Paris is certainly one of the most complete and exact of the kind ever attempted.

* * Over the American section, in the Machinery Hall at the Paris International Exhibition, an incription has been put up stating that the United States possess steam engines of 450,000 horse-power, the power of which is transformed into electrical energy; and that, apart from transmission of power, this energy is used to supply current nightly to 2,000,000 incandescent lamps and 250,000 arc lamps.

* * A broken needle was extracted from the foot of a little daughter of Mr. J. F. O'Connell, of 40 South Prospect street, after having remained in the flesh for seven or eight weeks, by the powerful magnet at the works of the Hartford Electric Light Company, last week. The piece was about three-quarters of an inch long, and evaded the search of the physician. Electrical surgery is getting to be a frequent occurrence at the station of this company.

* * There is a rumor, says the Burlington (Ia.) *Hawkeye*, and a very universal hope that the rumor may speedily become a fact, that the main lines of the Burlington street railways will soon substitute a better and more practical locomotive power for the horses and mules of dreary look and doubtful working capacity that are employed at present. This will be a step forward which will be quite a consummation. The coming power, of course, will be electricity.

* * All the stock necessary to insure the building of the Union Street Railway, to connect Freedom, Rochester, Bridgewater and Beaver, Pa., has been subscribed, and indications are that the work will be commenced within the next three weeks. Citizens of Van Port, a short distance below the county seat, have offered to add $5,000 to have the railway extended to that place. Electricity will be used as a motive power. The capital of the company is $45,000.

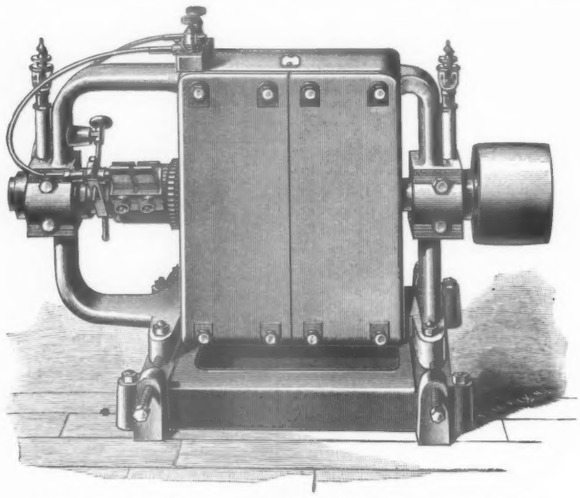
* * The East Harrisburg Passenger Railway, which has been in operation upon the Sprague system for some eight or nine months, and which has already once ordered an additional number of cars, has recently sent in a second additional order to the Sprague company for cars, this time two in number, to increase the equipment which they now have in operation. Indeed, there is hardly, we understand, an electric railway which has been in operation for any considerable time, which has not ordered an additional number of cars.

* * The Westinghouse Electric Company, of Pittsburgh, Pa., intend to have a new electric car on the market by the opening of the fall. The overhead system will be used. The new car will employ a Tesla motor, without any brushes or commutator, besides which no gearing will be employed. The alternating current will be used which will reduce the size of the wire and largely augment the efficiency of the apparatus. Mr. George Westinghouse has given a young Pittsburgh inventor $25,000 for an appliance to go on the car. On each car two motors will be used. No electric current passes into the core of the motor whatever, except through induction. The motor can be hermetically sealed, as there will be no occasion of opening it to get at the interior.

* * A new building is to be put up during the summer for the accommodation of the new department of electrical engineering at Princeton College.

The Eickemeyer Motor.

The accompanying illustration shows the general type of the Eickemeyer electric motors, which are made in all sizes from one-half to 25 horse-power, and wound for incandescent circuits up to 200 volts. In common with the Eickemeyer dynamo they possess advantages of freedom from sparking, solidity, freedom from vibration, and fine mechanical construction generally. The tension base for belt adjustments is a feature which is well shown in the illustration. J. H. Bunnell & Company, of this city, are the sole agents for both the Eickemeyer motors and dynamos.



General Type Eickemeyer Motor, Showing Tension Base.

* * John Stephenson Company (Limited) are now preparing a lot of especially fine cars for the Salt Lake City Railway Company, which are to be supplied with electric motors by the Sprague Company, making a first-class plant.

Electric Tramways at the Thomson-Houston Factories.

A need of better facilities for the handling of supplies and products in large manufacturing establishments has led to the adoption of the electric motor as shown in the accompanying illustration. A greater part of the large mills being supplied with electric lighting systems renders this an easy matter, and it is safe to predict that before long the electric tramway will come to be considered a necessary feature in mill equipment.

The Thomson-Houston Electric Company has already equipped several tramways, and has contracted for others which will soon be put in operation. The tramway car at the company's works in Lynn is used for carrying heavy machinery to different parts of the factory, and its use permits the handling of apparatus with much greater ease, in less time and with less labor than could possibly be accomplished by any other method. The car is equipped with two three horse power motors and easily carried up a grade of 13 per cent. a load of five tons, while from eight to ten tons can be carried on a level. The motor receives its current through an overhead wire from one of the generators in the factory.

* * As predicted in these columns, the Newton, Mass., aldermen have granted the local street railway company to use the overhead single trolley electric system. The company must have its tracks laid within six months, use iron poles 20 feet high and give a bond of $10,000 to insure the city against damages to its fire alarm signals, etc.

Experiments on Bichromate Batteries Without Diaphragms.

Prof. E. Laudmann states that the cells have a height greater than their diameter, and contain about six litres of a solution of 12 parts of bichromate of sodium in 100 parts of water, to which 25 parts of sulphuric acid is added. If about one square dm. of zinc is exposed to the solution, it will not need to be changed for two hours. Owing to their very low internal resistance these cells can be conveniently used for working glow lamps coupled in parallel. On account of the small quantity of material required, the difficulty of crystallization, and the low price of the material, the bichromate of sodium is to be preferred to the potassium salt or to chromic acid. The depolarization and E. M. F. is greater with porous carbon than with hard close-grained carbon. The zincs used should be free from carbon and iron, since, if the cells are coupled in parallel, local action may be set up.

Electric Tramcar at the Thomson-Houston Factory.

* * On the evening of May 27, the Lynn Board of Aldermen granted the Lynn and Boston Railroad Company the right to use the electric system of car propulsion in the streets.

* * The construction of the new "loop" line of electric road, to take in the Newtons, Waltham and Watertown, and to connect with the West End Company's Cambridge (Mass.) line, will begin next week. Electric cars may be running over the line early in August.

* * Scientist Jansen, of the Mendon Observatory, has recently been engaged in examining the electric lights on the Eiffel tower, in the Paris Exposition grounds, with a spectroscope. He finds that at a distance of eight miles oxygen is present in a group of electric rays, tested after the manner of a solar spectrum. Prof. Jansen therefore concludes that this effect is due to oxygen in the atmosphere. There is no oxygen evident in a solar spectrum. The spectra of the sun are white.

Electricity for 1,300 Buildings

OVER 25 MILES OF ELECTRIC LIGHT WIRE IN A SINGLE STRUCTURE.

There are 1,300 buildings in Philadelphia supplied with electricity for light or power purposes, and on not one of these has there been any loss by fire for two years past. "This is fairly plain evidence," said Inspector William McDevitt, of the Insurance Patrol, "that the electric current when promptly handled carries no risk with it.

"It was eight years ago that electric lighting became a commercial success. Ever since that time the insurance men of the city have had a system of inspection in force to secure care in laying the wires and the necessary safeguards against accident. The rules for the government of the electric light companies are not nearly as numerous here as in some cities. It is, of course, impossible to draw up a set of regulations that shall hold good for any number of years. Electricity is too progressive a science for that, and constant modifications and adjustments have to be made.

"The greatest problem that confronts us is to provide for the concealment of the electric wires. There is great danger in concealment, but at the same time electricity is making its way as a luminant into private houses, and to expose wires in such cases is to create an eyesore. We always recommend that wires be exposed. Numerous attempts are being made now to devise a conduit for the wires which shall be waterproof and, at the same time, incombustible. Another point about which we require particular care is the size of the wire that is used to carry the current. Copper wire is expensive, and there is a temptation to make it very fine. Where the wire is too small to carry the current needed heat is sure to be generated.

"The duties of inspection are made particularly hard, owing to the many systems of electric lighting in use in Philadelphia. There are no less than ten different companies now operating, and rules for each are necessary. The greater the simplicity of our system the better for the public."

Smit's Arc Light Dynamo.

We extract the following from our London contemporary, *Industries*, to give our readers an idea of the relative differences between American and foreign types:

"We illustrate herewith a type of arc light dynamo which is now being manufactured by Messrs. Willem Smit, of Slikkerveer, Holland. The field is of the McTighe type, and the sectional areas of magnets and armature core are purposely kept small, so as to insure high magnetic saturation and a drooping characteristic which is an advantage for working arc lamps in series. The machine is intended for an output of 14 amperes at 600 volts terminal pressure, the speed being 800 revolutions per minute. The weight of the machine, exclusive of the sliding bed, is slightly over 20cwt. The lower pole piece is magnetically insulated from the bed plate by a zinc base, so as to obtain an absolutely symmetrical field. The armature is of the Gramme type, having a core of soft iron wire supported on a gun metal center piece, and is wound on the outside with three layers of 58 mils wire, the total weight of wire on the armature being 44 pounds, and total length about 4,000 feet, or 6.6 feet per volt in the external circuit. The field coils contain 256 pounds of 0 134 mils wire. The armature measures over the winding 14 inches diameter by 15 inches long, and the commutator contains 72 sections. The machine is intended for feeding twelve arc lamps in series."

[The weights would be considered excessive in our home practice. We suppose the bed plate and the bearing standards use up a large proportion of the weight, since the magnet and armature sections are made small. The weak field, however, would indicate probability of considerable sparking at the brushes.—EDITOR.]

The National Association Bulletin.

Mr A V. Garratt, secretary and treasurer of the National Electric Light Association, has just issued Bulletin No. 1 of the Association from the headquarters 18 Cortlandt street, New York. It is neatly gotten up and well edited, containing much interesting information concerning the approaching meeting at Niagara Falls, the doings of the various committees since the Chicago convention, the treasurer's report, showing a satisfactory surplus, and that 48 new members have been added since the last report, beside a complete list of the members of the Association with addresses and business occupations, alphabetically arranged. Accompanying the bulletin is a circular letter addressed to manufacturers and dealers in electrical supplies inquiring as to space required for exhibition purposes at Niagara Falls. The following letter published in the Bulletin is of interest:

NIAGARA FALLS, May 10, 1889.

Allan V. Garratt, Esq., Secretary and Treasurer National Electric Light Association, 18 Cortlandt Street, New York.

DEAR SIR:

Arrangements for the August Convention are progressing. Headquarters will be at the International Hotel. The sessions will be held in the new Casino, immediately adjoining, which is large enough to accommodate all the members with visitors.

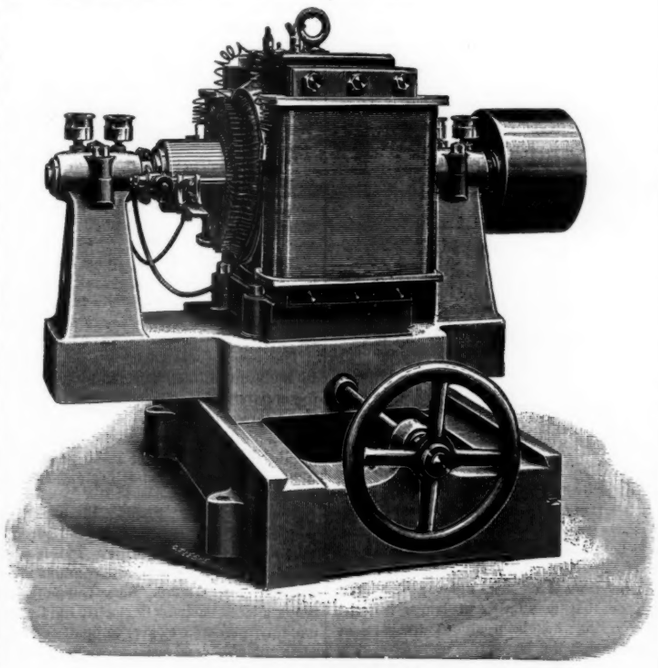
The exhibit at the Chicago Convention grew to such large proportions, and the expense was so great, that both the exhibitors and the Executive Committee took formal action, before leaving Chicago, discouraging a large exhibit at Niagara Falls. It is found, however, that some members of the Association are members for the sole purpose of making exhibits at the conventions; others have novelties brought out during the current half year, and some insist on making an exhibit at any rate. It has been thought best, therefore, to provide for an exhibit on a moderate scale, and a number of rooms have been engaged in direct connection with the convention hall. Applications for space may be made to the secretary.

Indications are that the Niagara Falls convention will be a large one. There seems to be a prevailing sentiment in favor of the attendance of the wives and lady friends of the members, and special arrangements will be made for their comfort and entertainment.

Further details of the programme of the convention, and plans for visiting points of interest at and near Niagara Falls, will be made public in a later bulletin.

BENJAMIN RHODES,
Chairman Executive Committee.

—— The Consumers Electric Light and Power Company, of Batavia, N. Y., has decided to locate its works on the line of the Erie railroad, between Evans street and the creek, and is negotiating with the Erie officials for the lease of the land.



SMIT'S ARC LIGHT DYNAMOS.

—— At a meeting of the stockholders of the Worcester, Mass., Electric Light Co., Saturday evening, it was voted to increase the capital stock of the company from $125,000 to $200,000, to provide for the land recently purchased, a new building and new and improved machinery. The directors will now have plans prepared for a model electric light building, and will make a thorough examination of the latest improved machinery.

—— We have not written a line for several days in regard to lighting the streets with electricity rather than with the tallow candle gas burners. This remark means no reflection, either, upon tallow candles. These are up to the standard. But the electric lights are coming. Soon we shall have all the principal streets properly illuminated, and in due process every street and avenue in Cincinnati will have arc lights of the latest improvement spreading their rays all around and making the streets and ways at night almost as light as at day. This advance will greatly diminish the demand for increased police supervision. There is no better police power than light. It is gratifying to know that this light is coming. It is slow, it is true, but it is coming.—*The Commercial Gazette, Cincinnati.*

—— The citizens of Batesville, Ala., want an electric lighting plant.

—— The East River Electric Light Company, of N. Y., announces that it is now prepared to furnish arc and incandescent lights in any quantity and to burn during any hours on its circuits in the principal streets of the city. The Thomson-Houston systems of arc, incandescent and alternating lighting are used.

—— Samuel J. Shea, Frankfort, Ky, wants to purchase electric plant for the steamer "Grace Morris," consisting of the following: One five-light (2,000 candle-power) dynamo, one engine suitable to run same, four 2,000 candle power single carbon lamps, one 2,000 candle-power focusing lamp, wire insulators, etc.

—— By the new $25,000 contract with the local electric light company, Springfield, Mass., is to be more brilliantly lighted than ever before, and all night in place of an arrangement which used to cut off the lights at the darkest hours; and the total cost for this increased and better service will be some thousands of dollars less than was paid for the old order of things last year. The local electric light company naturally desired to serve the city in this matter, and the committee of the city government have been strenuous in looking out for the interests of the people.

ELECTRIC LIGHT NEWS

—— Electricity for indoor lighting is being used extensively in Central City, Col.

—— The contract to light Saratoga Springs has been given the Westinghouse Company.

—— At Portland, Me., the Ottawa House is entirely lighted by electricity, 350 incandescent lights being employed.

—— The local lighting contract for Oil City, Pa., has been awarded to the Thomson-Houston Company, of Philadelphia.

—— The citizens of Portchester, N. Y., are contemplating the establishment of an electric lighting plant for their town.

—— It is reported that the Pennsylvania Globe Gas Company, of Wilmington, Del., are to enter the electric lighting business there.

—— It is rumored that the Millville (N. J.) Gaslight Company is negotiating for the plant of the Millville-Schuyler Electric Light Company.

—— The rapid adoption of electric light in Japan has caused a proposal to increase the capital of the Tokio Electric Light Company from $250,000 to $500,000.

—— L. L. Brown Paper Co., of North Adams, Mass., are putting in the Mather electric light system in their Centre street mill. The light will greatly facilitate night work.

—— The petition of the Hartford (Conn.) Light and Power Company for an amendment to its charter allowing the manufacture and sale of water gas has been refused by the State Senate.

—— The Sawyer-Man Electric Company, 510 West 23d street, New York, on Monday, May 27th, received from all parts of the country orders for 14,750 incandescent lamps. This is a sample day, showing the enormous growth of the business of that company, and it should be remembered that this is the dull season.

—— The directors of the Moorestown (N. J.) Electric Light, Heat and Power Company have been holding a series of meetings, to which representatives of the different electric light companies have been invited, to explain the advantages of their respective systems. Other representatives will be heard, after which specifications will be drawn and submitted to the different companies.

—— At a special meeting of the village board of Newark, N. Y., on Thursday evening, it was voted to make a contract with Moffett, Hodgkins & Clarke, for electric lights, and yesterday afternoon the contract was signed and work will be commenced at once. There are to be 40 arc lights of 2,000 candle power, to burn 26 nights each month until 1 A.M. The contract is for five years.

—— The Winton Place, Ohio, council has appointed a special committee on electric lighting, with instructions to make their report at a special meeting to be held. That they will have electricity in that suburb is not questioned, the object of appointing a committee simply being to decide which will be the best system to adopt. The commitee consists of Mayor N. W. La Rue, Councilmen Sabin, Robbins and E. F. Layman.

—— The Wabash, Ind., electric light plant was last week disposed of to a syndicate, composed of George Webster, Jr., of Chicago; J. S. Daugherty, A. W. Leedy and James Lynn, Jr. The Heisler incandescent system is used. The new company will at once put in a commercial system, besides continuing the street lighting contract with the city. Mr. Webster will be secretary and manager of the new corporation.

KINDRED INTERESTS

MANUFACTURING NOTES.

The Wyckoff Pipe Company, of Williamsport, Pa., are furnishing the Edison Electric Light Company of Philadelphia 14,250 feet of their patent wooden conduits for underground work.

The Electrical Supply Co., of Chicago, are handling a very complete line of electric gas lighting apparatus, which will be found fully illustrated in their new house goods catalogue, No. 647, recently issued.

The Export and Finance Company says that while Americans have always boasted of being the most progressive and enterprising people in the world, England, France and Germany have captured the enormous import and export trade of Mexico, Central and South America, and the West Indies, amounting to nearly $500,000,000 per annum.

A vigorous movement is now being organized to bring this enormous trade to this country. It naturally belongs to us. If our manufacturers, merchants, bankers and business men generally will give prompt and vigorous support, we can get it with all its attendant profits.

Westinghouse Machine Company.—Among the orders for their new automatic compound engines for the first three weeks in May the following prominent buyers may be mentioned: Baldwin Locomotive Works, Philadelphia, Pa., one 200 horse-power; Southern Cotton Oil Co., Memphis, Tenn., one 250 and one 200 horse-power; Omaha and Council Bluffs Railway and Bridge Co., Omaha, Neb., three 200 horse-power; L. Delannoy, Barcelona, Spain (for Clariana, Ciuro, Pubeonat & Co.), one 35 horse-power; Electric Improvement Co., San Francisco, Cal., one 80 and one 35 horse-power; Pennsylvania Institute for Feeble Minded Children, Elwyn, Pa., one 50 and one 35 horse-power.

The Westinghouse Electric Co. has divided the country into districts appointing in each an agent who is given charge of the selling business throughout his district. This plan of conducting the rapidly increased sales of the alternating current apparatus was begun some months ago and is now fairly under way. The company is now represented in their several districts by the following agents: William A. Carry, 620 Atlantic avenue, Boston, Mass.; Henry Hine, 120 Broadway, New York; D. A. Tompkins, Charlotte, N. C.; J. H. Gates, Marshall, Texas; W. C. Clark, San Francisco, Cal.; Guido Pantaleoni, St. Louis, Mo.; Geo. O. Fairbanks, the Rookery Building, Chicago, Ill.; A. T. Moore, Jr., Denver, Col.; H. W. Goode, agent for the northwest, has not yet established an office, but will doubtless be located at St. Paul or Minneapolis.

Messrs. W. D. Allen & Company, the Chicago representatives of the New York Belting and Packing Company, have just issued a new and attractive catalogue, containing description of a full line of vulcanized rubber goods, including belting, packing and hose. The cover, a buff tint, is very attractive and is printed in red and bronze. A view of the company's extensive warehouse and salesrooms, 151 Lake street, is shown on the back. It is a pamphlet of 40 pages, profusely illustrated, typographically correct in every particular, and great care and much labor has evidently been bestowed in its preparation and production. Its possession can not fail to be of benefit to those interested in the line of goods which Messrs. W. D. Allen & Company handle. Messrs. Allen & Company also represent the famous Hoyt leather belting, at Chicago.

The Thomson-Houston Electric Company reports the following sales: Binghampton, N. Y., 150 arc, 2,400 inc.; North Adams, Mass., 500 alt.; Petersburg, Va., 1,000 alt.; Yonkers, N. Y., 50 arc; Columbia, Tenn., 600 alt., 50 arc; Birmingham, Ala., 50 arc; Birmingham, Conn., 600 alt.; Americus, Ga., 50 arc, 500 inc.; Concord, N. H., 50 arc; Springfield, Mass., 90 arc; Anniston, Ala., 50 arc, 500 alt.; Lowell, Mass., 25 arc; Findlay, Ohio, 50 arc; Weymouth, Mass., 90 arc, 1,200 inc.; Canastota, N. Y., 600 inc.; Middleboro, Mass., 30 arc, 600 inc.; Somerville, Mass., 50 arc; Weatherly, Pa., 35 arc; Shelbyville, Ind., 90 arc; Pittsfield, Mass., 500 inc.; Fitchburg, Mass., 75 arc, 500 alt.; Manhattan Co., New York, 150 arc. It also reports the following sales of apparatus for isolated plants: S. W. Brady, Toledo, Ohio, 12 arc, 600 inc.; Hart & Co., Cleveland, Ohio, 200 inc.; H. Ricker & Sons, So. Poland, Me., 12 arc; H. W. Barrett, Louisville, Ky., 500 inc.; Cushings Island Trans. Co., Portland, Me., 300 inc.; Henderson Woolen Mills, Henderson, Ky., 200 inc.; New York *Tribune*, New York, 400 inc.; Dolphin Manufacturing Co., Paterson, N. J., 500 inc.; Fairbank Canning Co., Chicago, Ill., 70 arc, 1,000 inc.; Sheboygan Lumber Co., Sheybogan Mich., 4 arc light plant; Pierce City, Mo., 30 arc, 200 inc.; Plattsmouth, Neb., 35 arc, 600 alt.; Janesville, Wis 45 arc; Muskegon Chemical Fire Engine Co., Muskegon, Mich., 50 inc.; Illinois Steel Co., Joliet, Ill., 200 inc. New contracts for street railways are: The Citizens' Elec. Street Ry., Decatur, Ill., four cars, five miles; Redbank & Seabright Ry. Co., Redbank, N. J., three cars, five miles; Richmond St. Ry. Co., Richmond, Ind., six cars, four miles; Ross Park St. Ry. Co., Spokane Falls, W. T., six cars, seven and one-half miles.

A New Company.

The motor department of the Thomson Houston Electric Company has been capitalized and will be known as the Thomson-Houston Motor Company. The capital is $1,000,000, and the company is organized under the laws of Maine. The company bears the same relation to the Thomson-Houston Electric Company as does the International Company.

—— The installation of incandescent lights in Boston this spring has been amazingly large, considering the general dulness of this season when the days are lengthening and light is not so much used as in other seasons. It is stated by the manager of the largest central electric lighting station in Boston, that the number of lamps installed this spring has been almost 100 per cent. more than it was last spring up to date. The installation of electric motors for power purposes that are run by a current generated at the central station has been very large of late.

—— A very important transaction took place at Xenia, O., last week in the purchase and transfer of the majority of the stock of the Xenia Electric Light and Power Company, held by Ed. Schmidt, R. R. Knowles and R. J. Stewart, to J. H. Harbine and Eli Millen, principal stockholders of the Xenia Gas Company. The electric light company was formed here less than a year ago, is separate and distinct from the plant owned and operated by the city, and is said to have been paying big dividends on amount invested. The plant will be run as usual, and possession was given at once.

—— The following bill reported by the special joint legislative committee on cities and mercantile affairs, is now before the Massachusetts Legislature. All provisions of law granting to cities and towns authority to regulate telegraph and telephone lines shall, so far as possible, apply to every corporation, copartnership, or person having authority to place posts, wires, structures and other appliances for any purpose in or under public ways or places, and the selectmen of towns and the board of aldermen in cities, may cause the removal, at the expense of the owner or owners, of any unused posts, wires or structures or other appliances.

The Ellis Oil Filter.

An electric generating station with its high speed machinery and continuous operation is a great consumer of oil, and any means of lessening this consumption is gladly welcomed. For this reason the filtration of oils has become one of the regular processes of electric station work. The illustration shows the Ellis filter which is manufactured by the Electrical Supply Company, of Chicago. This filter it is claimed contains

THE ELLIS OIL FILTER.

all the requisites for perfectly restoring oils to their original color and grade after passing through the journal bearings of high speed machinery. The company guarantee that the oil filtered will be purer in quality than when drawn from the original package. That the filter clean up the same oil over and over again, returning it as pure as when first filtered. That it will not require one hour's attention per year, and claims it will save its cost on the first two or three barrels of oil used.

I believe the true functions of government to be *to regulate and control, not to own and operate* commercial industries.—*Economic Value of Electric Light and Power.*

The uses of electricity are limited only by the want of intelligence in producing fitting apparatus for its application. The demand for such apparatus is limited only by the want of intelligence on the part of the public to know how to use it properly.—*Economic Value of Electric Light and Power.*

The Fitchburg Steam Engine Company have just issued a special circular relating to electric lighting. This is made up in a compact form, and contains much valuable information. The company are doing a large business in electric light work, and are prepared to give estimates on complete plants, condensing, compound condensing, or otherwise.

The new cars from the Stephenson Car Works, New York, recently put on the East Reading road, are probably the most comfortable electric cars now in use. They have the new Stephenson truck which takes all the machinery and appliances, and the body rests upon "super" rubber springs, thus completely insulating the body from all noise, jar or shocks, and giving greater ease and comfort to passengers.

If American merchants, manufacturers, bankers and business men generally, are enterprising and patriotic, and mean business, now is the time for them to join in the great effort to secure the enormous trade of South America. This trade amounts to about $500,000,000 per annum, 90 per cent. of which now goes to England, France and Germany.

Export and Finance is a new weekly journal, established by prominent journalists to help secure this trade. Send an annual subscription of five dollars and help on the great work. Address, Export and Finance Pub. Co., 5 Bowling Green, New York.

—— Buffalo, N. Y., made several additions to her electric street lighting system last week, in spite of some strong opposition.

ELECTRICAL PATENTS

INDEX OF INVENTIONS FOR WHICH LETTERS PATENT OF THE UNITED STATES WERE GRANTED IN THE WEEK ENDING MAY 28, 1889.

403,905 Commutator; Harry H. Blades, Detroit, Mich., assignor to the Detroit Motor Company, same place.

403,941 Automatic cut-out for electric lamps; Edward R. Knowles, Brooklyn, N. Y., assignor to the Mutual Electric Mfg. Co., of New York.

403,944 Electric gas lighter; Joseph H. Lehman, Philadelphia, Pa.

403,955 Porous cup for batteries; Clarence B. Noble, Cleveland, Ohio.

403,957 Secondary battery; John B. Price, Wollaston Heights, Mass., assignor to The Electrical Accumulator Co., of New York.

403,964 Arc lamp; William L. Silvey, Cincinnati, Ohio.

403,969 Trolley for electric railway; Thomas Streat, Richmond, Va., assignor to himself and Edward Whitlock, same place.

404,015 Electrical switch for elevators; William E. Nickerson, Cambridge, Mass.

404,067 Electric motor; Warren S. Belding, Chicago, Ill., assignor to the Belding Motor and Mfg. Co., same place.

404,068 Dynamo; Warren S. Belding, Chicago, Ill., assignor to the Belding Motor and Mfg. Co., same place.

404,069 Clamp for electric motors; Warren S. Belding, Chicago, Ill., assignor to the Belding Motor and Mfg. Co., same place.

404,112 Automatic circuit interrupter, for electric circuits; Albert L. Reinmann and Philip Lange, Pittsburgh, Pa., assignors to the Westinghouse Electric Company, same place.

404,414 Electric converter box; Albert Schmid, Allegheny, Pa., assignor to the Westinghouse Electric Company, Pittsburgh, Pa.

404,418 Apparatus for treating filaments; Frank S. Smith, Pittsburgh, Pa., assignor to the Westinghouse Electric Company, same place.

404,120 Regulating self-exciting alternative-current electric generators; William Stanley, Jr., Great Barrington, Mass., assignor to the Westinghouse Electric Company, Pittsburgh, Pa.

404,139 System of electrical distribution; George Westinghouse, Jr., Pittsburgh, Pa.

404,149 Trolley for electrical railways; David A. Ainslie, Richmond, Va.

404,154 Lightning arrester; Reginald Belfield, Pittsburgh, Pa., assignor to the Westinghouse Electric Company, same place.

404,165 Telegraph; John Burry, New York, N.Y., assignor of two-thirds to James E. Munson and Aloys Wirshing, both of same place.

404,168 Secondary battery; Henry F. De B. Cameron and Thomas Harris, Detroit, Mich., assignors of one-third to Alfred Woodward, same place.

404,170 Electrical signaling apparatus; John P. Coleman, Swissville, Pa.

404,220 Method of rendering nickel and nickel alloys non-magnetic; Heenrich Ostermann and Charles Lacroix, Geneva, Switzerland, assignors to the Usine Genevoise de Dégrossissage d'Or, same place.

402,221 Electrical switch for elevators; Wm E. Nickerson, Cambridge, Mass.

404,226 Fire and police signaling apparatus; Arthur C. Robbins, Brooklyn, N. Y.

404,232 Pole for electric wires; Udolpho Snead, Louisville, Ky.

404,244 Arc lamp; La Motte C. Atwood, St. Louis, Mo., assignor of one-half to Frank T. Robinson, same place.

404,245 Electric arc lamp; La Motte C. Atwood, St. Louis, Mo., assignor of three-fourths to Frederick Skrainka, Louis Skrainka, and Edward B. Roth, all of same place.

404,306 Process of electric riveting; Elias E. Ries, Baltimore, Md.

404,310 Electric meter; Robert P. Sellon, Lambeth, county of Surrey, England.

404,324 Electro-dynamic motor; Charles J. Van Depoele, Lynn, Mass.

404,325 Closed slotted conduit; Charles J. Van Depoele, Lynn, Mass.

404,332 Process of separating ores by magnetism; Clinton M. Ball, Troy, and Sheldon Norton, West Troy, assignors of one-third to Alexander T. Porter, West Troy, N. Y.

404,333 Magnetic pre-separator; Clinton M. Ball, Troy, and Sheldon Norton, West Troy, assignors of one-third to Alexander T. Porter, West Troy, N. Y.

404,334 Process of separating ores; Clinton M. Ball and Sheldon Norton, West Troy, N. Y., assignors of one-third to Alexander T. Porter, same place.

404,351 Electric arc lamp; John R. Fox, Fort Wayne, Ind.

404,361 Electrical apparatus for controlling elevators; Ronald F. McFeely, Pittsburgh, Pa., assignor to the Electro-Hydraulic Company, same place.

WANTED.—Cheap system of Telephone for interior of large building.

Address P. O. Box 3391, City.

MOULDINGS For Electric Light Work.
Wooden Dynamo Frames, Etc.
John A. Robertson, 393 Federal Street, Boston, Mass.

Sperry Electric Company,

Factory, 194 to 198 So. Clinton St., Chicago, Ill.

MANUFACTURERS OF THE

Improved Sperry High and Low Tension Systems of Arc Lighting,

Claiming the Highest Efficiency, Reliability and Durability. Perfect Regulation.

THE NATIONAL GALVANIC BATTERY

UNEQUALED FOR BELLS, TELEPHONES, GAS LIGHTING, ETC.

PLATINUM CARBON CONNECTION.

PERFORATED BODY.

The only real improvement of a POROUS CUP.

NO SOAKING REQUIRED.

ALWAYS WORKS INSTANTLY,

WILL LAST A LIFE TIME.

SIMPLE, CLEAN, DURABLE.

Write for circulars & prices.

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241 Main St., CINCINNATI, O

18 Cortlandt St., NEW YORK.

NOTICE TO THE TRADE.

A. L. BOGART,

22 Union Sq., N. Y.,

No. 9 Barthoidi.

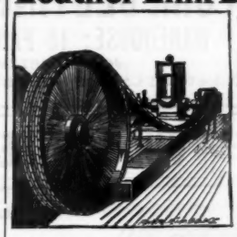
Is the sole owner of U. S. Patents covering certain Electrical Gas-Lighting Burners, Cut-Offs, Burglar Alarm, Gas-Lighting Attachments, and other electrical appliances connected therewith, all of which are manufactured exclusively by him, and are sold to the trade on the most favorable terms EXPERTS will use none other, on account of their superior workmanship, and practical utility.

Suits are now pending in the U. S. Circuit Courts against infringers of the Bogart Patents in the cities of New York, Philadelphia and Boston.

Illustrated Circulars, price-lists and discount sheets forwarded to the trade on application, accompanied with business card.

AMERICAN

Leather Link Belt Co.



"American Patent Joint"

Leather Link Belting

Specially adapted to *DYNAMOS.*

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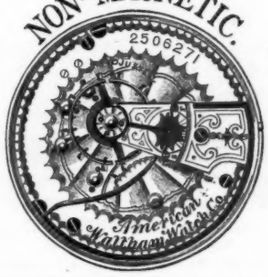

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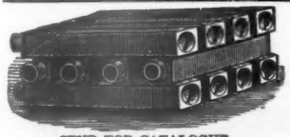

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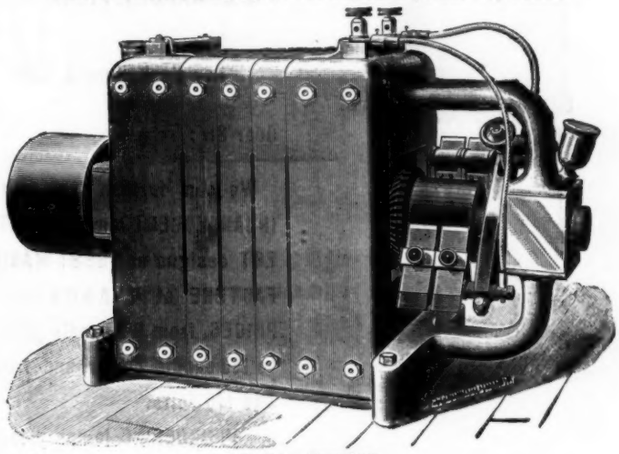

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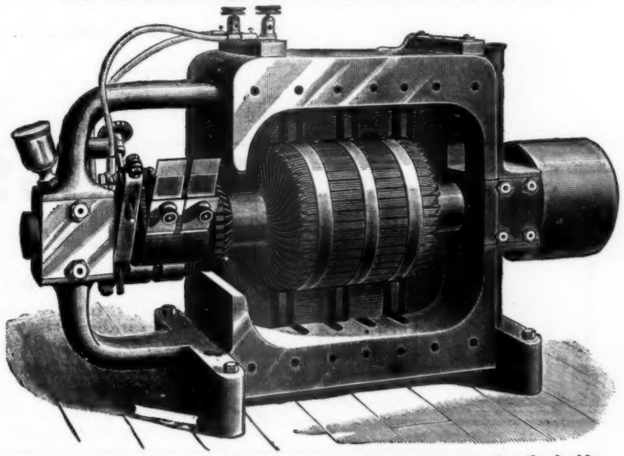

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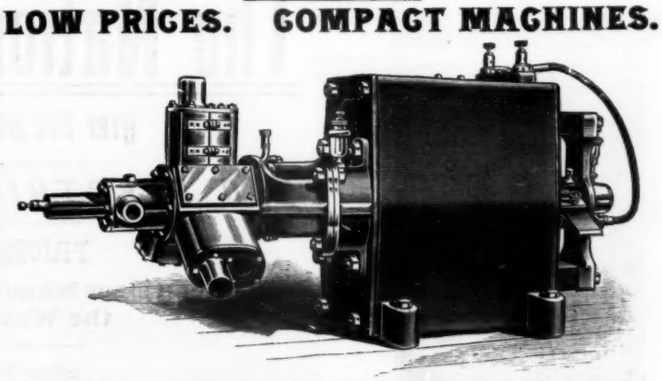

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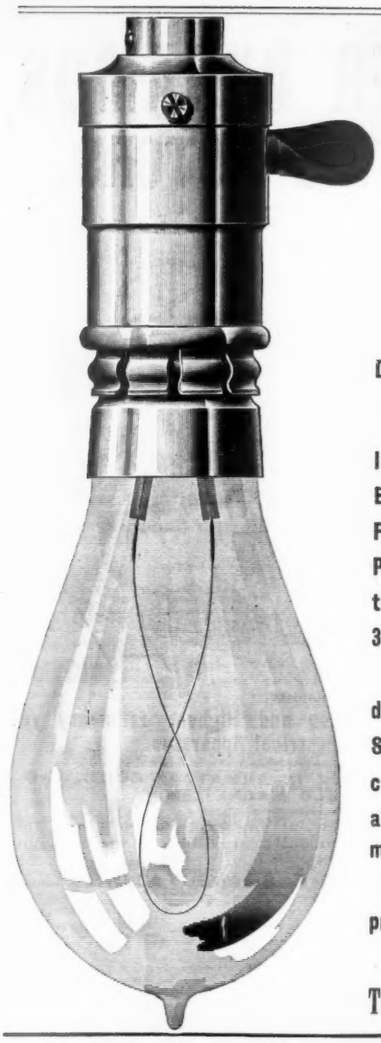

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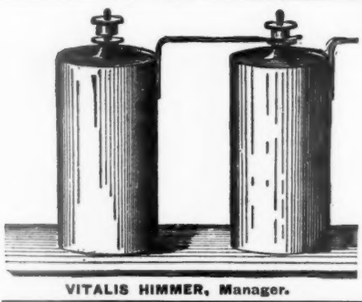

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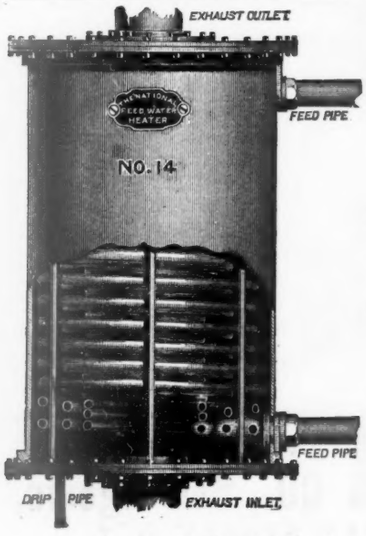

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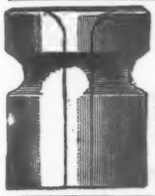

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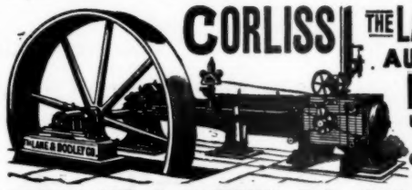

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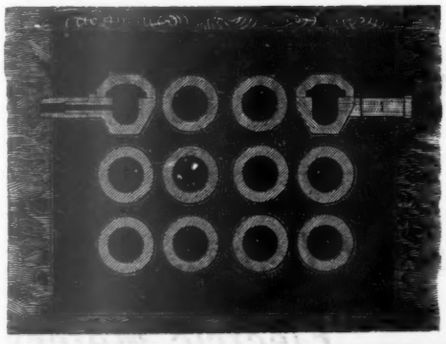

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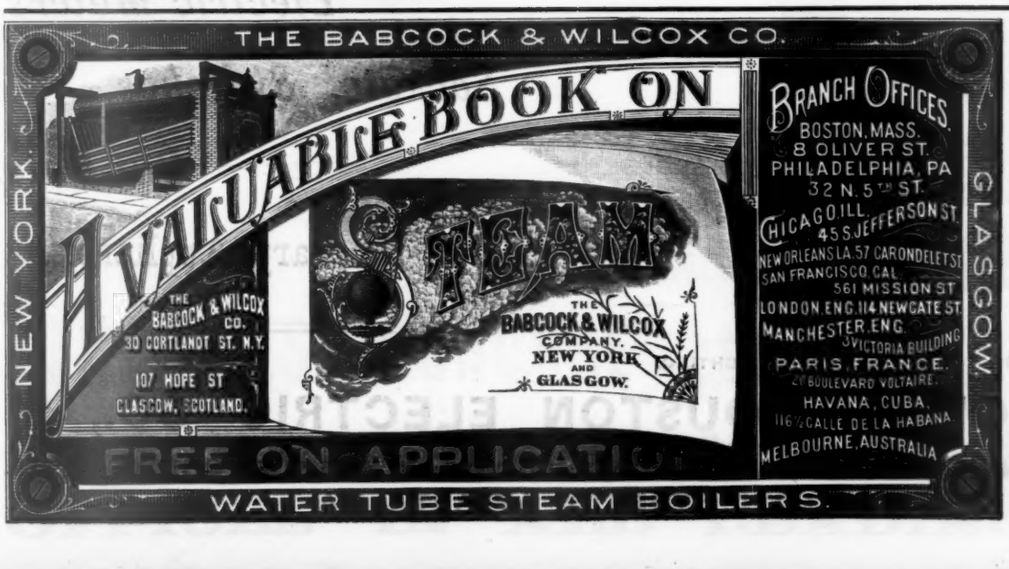
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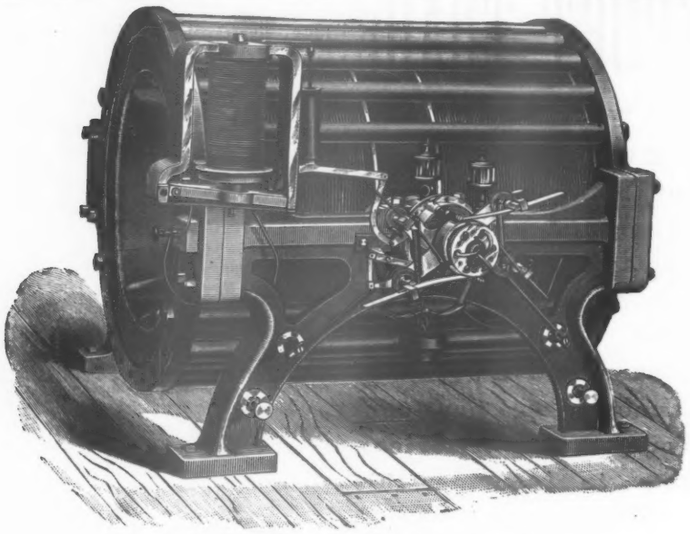

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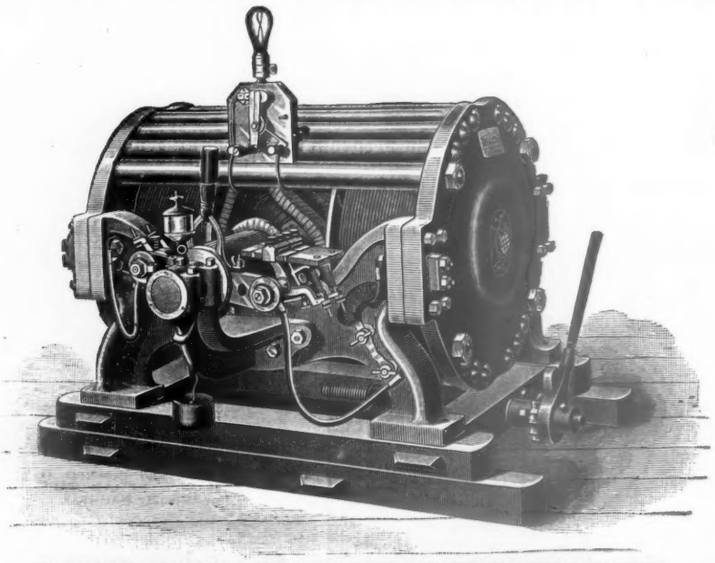

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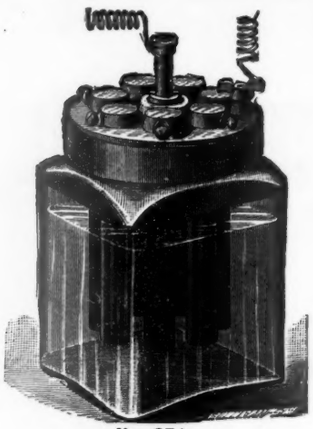

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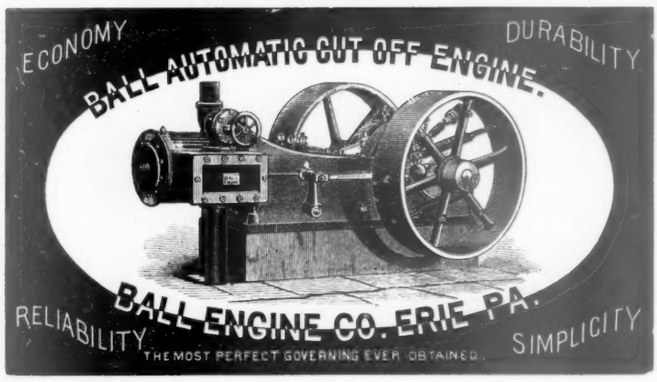

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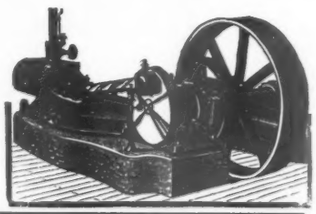

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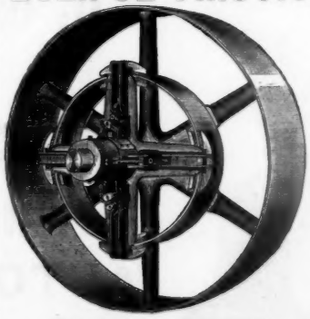

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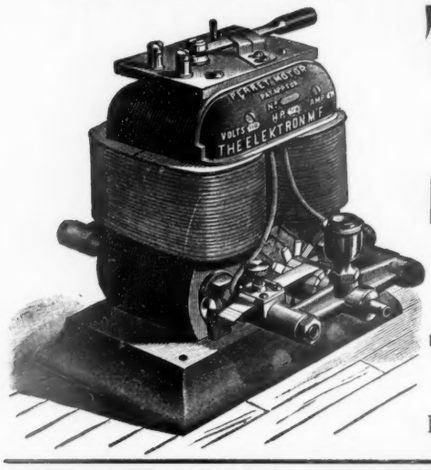

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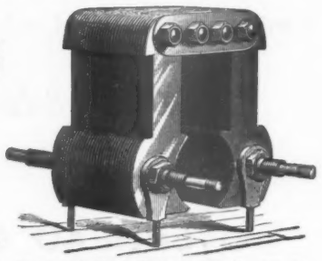

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Bay Ridge Electric R. R.	Bay Ridge, Md.	Lindell Avenue Street Ry.	St. Louis, Mo.
Buffalo Street R. R.	Buffalo, N. Y.	Lindell Avenue R. R.	St. Louis, Mo.
Carbondale & Jermyn R. R.	Carbondale, Pa.	Long Island City & Newtown R.R.,	Long Island City, N. Y.
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Collamer Line	East Cleveland, O.	Naumkeag Street R. R.	Salem, Mass.
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East Side Street R. R	Brocton, Mass.	Passenger R. R.	East Harrisburg, Pa.
Eau Claire Street R. R.	Eau Claire, Wis.	Passenger R. R. Extn.	Harrisburg, Pa.
Federal Street & Pleasant Valley R. R.	Pittsburgh, Pa.	Penna. R. R. System	Atlantic City, N. J.
Peoples R. R.	St. Joseph, Mo.		
People's R. R	Scranton, Pa.		
Plattsmouth Electric R. R.	Plattsmouth, Neb.		
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Steubenville Electric R. R.	Steubenville, Pa.		
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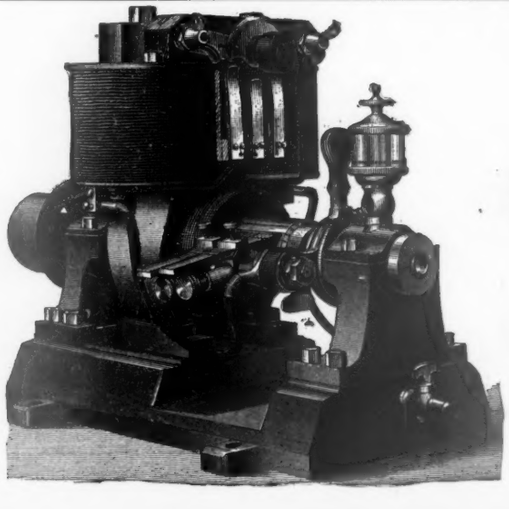

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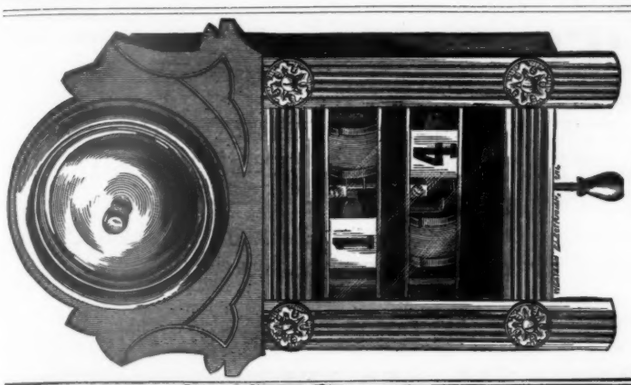

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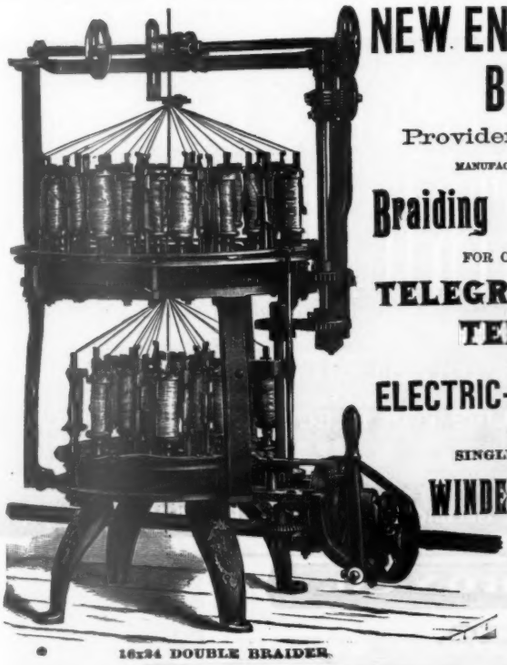

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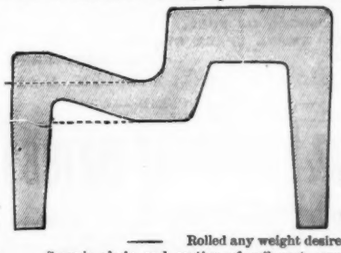

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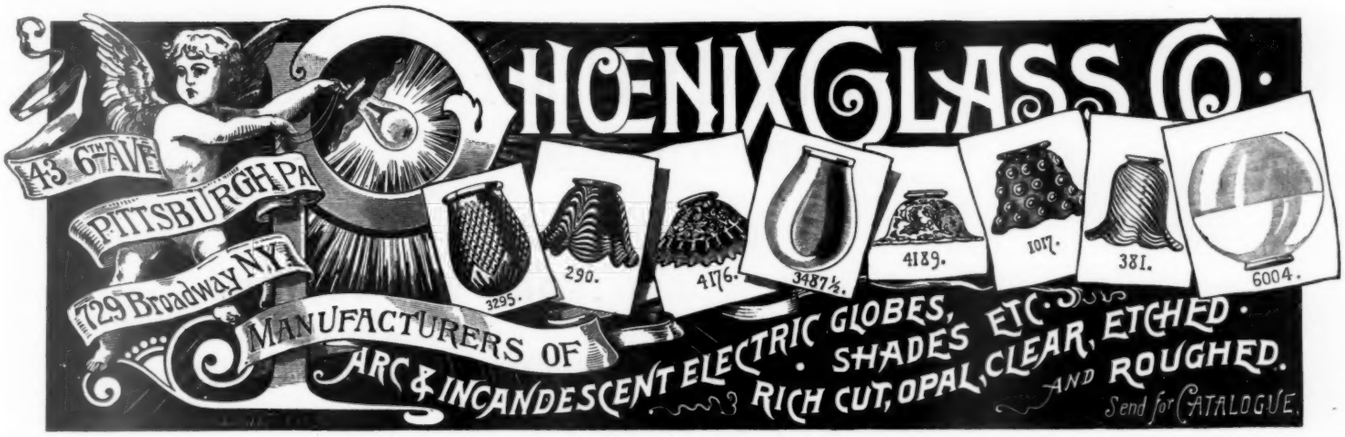

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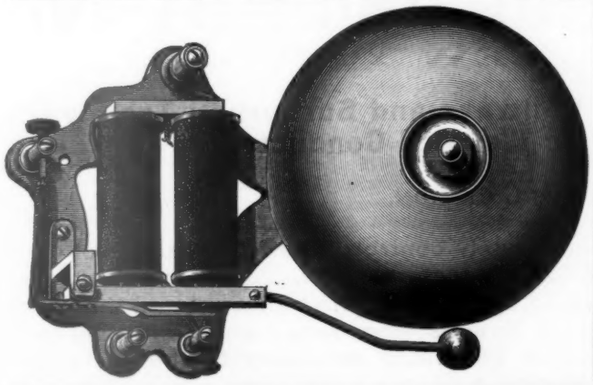

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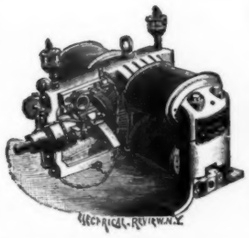

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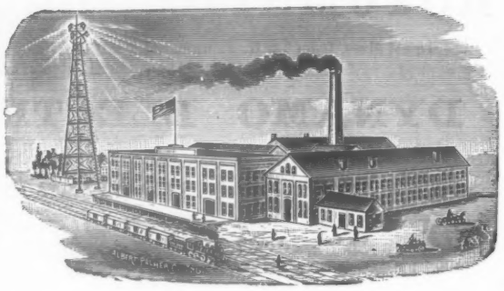

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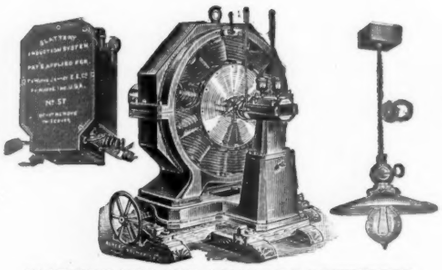

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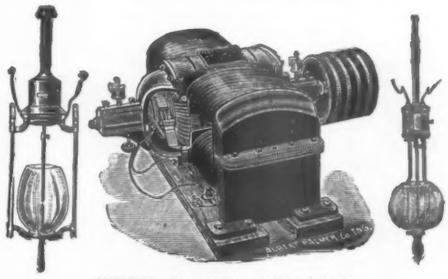

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